

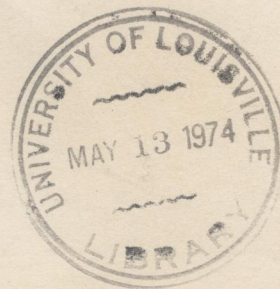
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environmental impact statement

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GOVERNMENT DOCUMENTS



MAMMOTH CAVE

NATIONAL PARK / KENTUCKY

environmental impact statement
draft



GOVERNMENT DOCUMENTS

MAMMOTH CAVE

NATIONAL PARK & KENTUCKY

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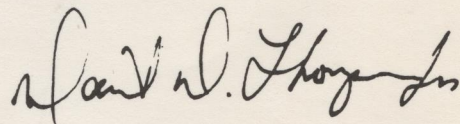
Department of the Interior

Draft
Environmental Impact Statement

DES 74-43

Proposed
Mammoth Cave National Park Master Plan
and Wilderness Study
Kentucky

Prepared by
Denver Service Center
National Park Service
Department of the Interior

A handwritten signature in dark ink, appearing to read "Robert W. Thayer". The signature is fluid and cursive, with a large initial "R" and a long, sweeping underline.

Regional Director, Southeast Region

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P76
1974

Department of the Interior

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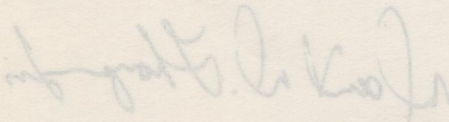

Regional Director, Southeast Region

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Overflow parking occurred at Historic Entrance almost daily from mid-June to Labor Day 1970. This condition has worsened since.



Visitors queued up waiting to buy tickets for cave trips and bus transportation on Easter Sunday 1971. Queue lines form daily when cave visits exceed 4000.

SYNOPSIS

This environmental impact statement provides the rationale for the major conclusions set forth in the preliminary draft master plan for Mammoth Cave National Park dated December 1970. Both of these reports are parallel in addressing themselves to the three zones for management and use defined in the Southern Appalachian National Park Commission's report to the Secretary of the Interior which culminated in the act of Congress of May 25, 1926 (44 Stat. 635) authorizing establishment of Mammoth Cave National Park to comprise:

- Mammoth Cave Plateau, beneath which the major cavern systems are located
- The beautiful valleys of the Green and Nolin Rivers
- Hilly Country, an area of rugged topography clothed with a deciduous hardwood forest

The area containing these features, according to the Commission's report, offered "exceptional opportunity for developing a great national recreational park of outstanding service in the very heart of our nation's densest population." Congress stipulated that the area would be administered, protected, and developed as a national park under the direction of the Secretary of the Interior and the National Park Service subject to the provisions of the act of August 25, 1916, entitled "An Act to establish a National Park Service, and for other purposes," as amended.

Following cession of jurisdiction over park lands by the Commonwealth of Kentucky and acquisition of sufficient lands in fee simple, the park was established formally on July 1, 1941. Since then scientific exploration has disclosed that the park contains outstanding underground and surface features, including the longest limestone cave system in the world, cave formations noteworthy for their proportions and diversity, a large population of cave animals some of which are found nowhere else, a highly developed karst topography, and rare vegetative communities.

Yet, Mammoth Cave has enjoyed the reputation for generations and is today the "foremost tourist attraction" in Kentucky. Located in south-central Kentucky, the park is equidistant (about 90 miles) from Louisville to the north and from Nashville, Tennessee to the south. These cities are connected by Interstate Highway 65, which passes within 2.3 miles of the park entrance. Mammoth Cave is the hub of a vacation region containing resorts, State parks, theme parks, museums, commercial caves, and other visitor attractions. Overnight lodgings, campgrounds, and tourist services are expanding greatly to meet the needs of vacationers and travelers alike. Mammoth Cave National Park contains roadways, trails both on the surface and underground, auto parking lots, a campground, primitive campsites, picnic area, guided tours, and a variety of interpretive activities provided by the National Park Service. Concessioners operate overnight lodgings, food services, curio sales, grocery store, automotive service

station, a sightseeing boat cruise on the Green River, and a shuttle bus service to cave entrances. Government guides lead the walking tours conducted in the passages of Mammoth Cave. The park is 51,354.40 acres in extent.

Of the 1.7 million park visitors in 1970, 611,000 entered Mammoth Cave. The vast majority of the other visitors participated in motor sightseeing mostly while traversing State Route 70, which crosses the south side of the park from east to west.

Through the preliminary draft master plan, published in December 1970, the National Park Service seeks

- to relieve automobile and visitor congestion over Mammoth Cave
- to diversify park use
- to provide a quality experience for all visitors

This is to be done in the context of the park's invaluable natural resources, increasing travel, changing visitor needs, and the growing tourist industry developing in the region surrounding the park.

To accomplish this, the master plan contains an interrelated series of actions, to be accomplished over a period of 10 to 20 years. These are addressed in this environmental impact statement under ten headings.

Actions affecting the Mammoth Cave Plateau are:

1. Expand number and variety of cave trips.
2. Create a new staging area on the park's periphery.
3. Transport all visitors by transit from this location.
4. Phase out existing facilities.
5. Modify intrapark road circulation.
6. Cease use of spring water which feeds the caves.

Actions affecting the River Valleys are:

7. Provide additional sites for picnicking and primitive camping.

Actions affecting the Hilly Country are:

8. Replace ferries with a bridge and build a new transpark road.
9. Establish a trail system.
10. Develop primitive campsites.

The following paragraphs relate, in capsule form, the interrelationship of the first five actions listed above:

During the decade of the 1960's, visits to Mammoth Cave increased at an average annual rate of 30,000. Concomitantly, the number of automobiles bringing these people increased proportionately to the point that the parking lot overflowed regularly, creating unsightly conditions and eroding park values. The visitor center became overcrowded. Cave trip parties were unwieldy and they were rushed through

with little opportunity to observe and even shorter time for explanation by the guides. The quality of the park experience was deteriorating. This saturation of the park's facilities and services was occurring from mid-June through Labor Day and increasingly on weekends and holidays the rest of the year. These conditions still prevail and are worsening.

Forecasts of travel to the park by the year 2000 are 2 1/2 times greater than present average daily loadings in the peak season. Could Mammoth Cave accept visitation of this magnitude? Bearing in mind physical, ecological, and psychological factors, and methods of use, it was determined that from 4 to 5 times the present average daily visitation could be admitted to the cave without unacceptable deleterious effects by providing new entryways and reopening unused passages. A greater variety of cave trips would be offered and parties would be smaller thus improving the quality of the experience.

Having concluded that the family automobile would continue to be the basic mode of transportation for the foreseeable future, a suitable location was sought for a parking area large enough to store the number of visitors' automobiles expected by that time. Space for expansion at Historic Entrance was too limited and more people there would only add to the present congestion. Likewise, space is insufficient at each cave entrance to provide separate parking lots. Moreover, even if such was possible physically, it would be too costly in dollars and environmental damage, both to the surface and underground.

Upon due consideration, a peripheral site was selected for a staging area on Joppa Ridge along Ky 70 at a place labeled Union City on early park maps, 3/4 mile within the park from its main entrance at Chaumont. This site was best logistically and would have minimal environmental impacts. From here visitors would be carried in transit vehicles to cave entrances, sightseeing boat dock, and to other points of interest in the southeast part of the park. By closing existing roads, these vehicles could use them for their roadbed without competing in traffic with visitors' automobiles. Transit vehicles will lessen air and noise pollution and result in significant savings in energy for propulsion. More cave trips of greater variety and with smaller parties will enhance the visitor's enjoyment.

In addition to storing visitors' cars, the staging area would contain a terminal building wherein space would be provided for visitor orientation/information, restrooms, food services, ranger station, and the like, and a transit loading dock.

Having thus cut off private vehicle access to the present staging area at Historic Entrance, the overnight lodgings, food services, campground, picnic area, visitor center, and related facilities over Mammoth Cave would be phased out gradually and the buildings razed followed by restoration of the area to a nearly natural appearance. Only those facilities to comprise the future Historic Entrance transit station would remain.

The investment at Historic Entrance will be nearly amortized before the plan is effected fully, but the concessioner will be entitled to a settlement of his properties as they are phased out or relocated. His investment is valued today at a little more than \$500,000. The government's facilities were constructed prior to 1966 and cost about \$920,000.

Discontinuing lodgings, food services, auto camping, and picnicking at Historic Entrance, and closing to private vehicles certain roads needed for transit roadbed will change long-established patterns of use and may result in loss of some jobs. However, the tourist industry is expanding in the region and those desiring continued employment in the hotel business should find it readily. Moreover, these changes in park use should stimulate private industry to provide accommodations and services which will probably, in the long run, enhance the local economy and bolster the tax base.

Present use and operational patterns at Mammoth Cave stem from 1816 when public tours began. Thus these proposals of the master plan call for some drastic changes which will require from 10 to 20 years to accomplish. During this time, there will be far-reaching ecologic, economic, and sociologic adjustments. These and their alternatives are discussed in detail in the body of this environmental impact statement.

The master plan addresses itself, also, to the problem of water supply. Presently it is collected from springs and wells on Flint Ridge in the park. Spring water is essential to the geologic development of the caverns and supplies nutrients to the cave fauna. At periods of low flow, virtually all the water is withdrawn from the springs for park use. Buying water from a newly established district in an adjoining county is favored by the National Park Service, but alternates are discussed as well.

The objective of diversifying park use is met in the master plan by:

- Providing for a greater variety of cave trips
- Encouraging sightseeing on the Green and Nolin Rivers and camping at selected locations
- Making the Hilly Country more accessible through
- Constructing a new transpark road and bridge across the Green River, and
- Establishing a new trail system with designated primitive campsites

The impacts of these and their alternates appear in the body of the statement.

One of the first steps in the master planning process, developed by the National Park Service, is to locate and evaluate the park's natural and cultural resources. Congress, through its act of August 25, 1916, charged the Service with perpetuating these resources and providing for their compatible use. Sites for the foregoing developments were selected that were in harmony with the national significance of the resources affected. To this end, park lands were mapped using the government-wide classification system, which recognizes six categories of use and preservation, and a cave passage

zoning system was innovated. These systems are explained in the appropriate part of this environmental statement.

As required by the Wilderness Act, the Service also studied the lands of Mammoth Cave National Park to determine whether or not they were suitable for designation as wilderness. Four roadless areas 5,000 acres or larger in extent were delineated. Prior to the park's establishment in 1941, its lands had been exploited for a century and a half. Evidences of these past uses are still generally apparent in the form of farmlands, wagon roads, fence lines, chimneys, foundations, gullies, and the like. Therefore, the lands in the park have not retained their "primeval character and influence," and "the imprint of man's works" is still noticeable. However, some lands may revert sufficiently over a period of time to qualify for wilderness, and these were identified in the master plan on the land classification plan drawing.

The language of the Wilderness Act defines the quality and character of the land surface. It makes no reference to "underground wilderness." On the other hand, the Service recognizes the inseparable affinity between surface and underground through geologic, hydrologic, and meteorologic processes by designating the surface of Flint, Jim Lee, and Joppa Ridges and their cave passages in a category that provides the greatest degree of "protection" possible under its organic act.

In assessing the impacts of the master plan proposals upon the region and the park, it should be borne in mind that exploitation of Mammoth Cave began in 1809 with the mining of cave dirt and the extraction of saltpeter from it, and that surface lands have been farmed and logged for generations. Nonetheless, the 30 years which have elapsed since the park's establishment in 1941 have brought to light much knowledge about relict vegetative types, Indian occupation, and mostly the vast extent of the cave passages. In sum, it is believed, having weighed the impacts, both favorable and adverse, that the changes and developments called for in the master plan are in the public interest, and that the visitor will have a higher quality experience.

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UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
Denver Service Center



SUMMARY

(X) Draft () Final Environmental Statement

United States Department of the Interior, National Park Service, Southeast Region

1. Type of Action: (X) Administrative () Legislative

2. Brief Description of Actions:

A new staging area for Mammoth Cave National Park, Kentucky, is to be built for storage of visitors' cars. In an orientation facility, visitors may select the activities, e.g., cave trips, hikes, sightseeing boat ride, which they desire to pursue and then board a transit vehicle to their destination. New entrances to Mammoth Cave will be built and trails extended to accommodate greatly increasing visitation. Existing concessioner and government facilities will be phased out over a 10-20 year period and essential services relocated. Natural flow of water is to be restored to the cave system on Flint Ridge. The Green River is to be bridged and cross-park road built to make the scenic hilly country more accessible to visitors. Through the techniques of land classification and cave zoning, the intensity of use and degree of preservation accorded park lands and cave passages has been defined. No lands were found suitable now to be proposed for inclusion in the National Wilderness Preservation System, because of past exploitation by farmers and loggers. Some may qualify in the future when man's works become less noticeable through the "healing processes of nature."

3. Summary of Environmental Impacts and Adverse Environmental Effects:

Phasing out of overnight accommodations — hotel and campground — will lessen the impact on park resources and encourage private enterprise to expand further and provide additional facilities outside the park. Transportation of all park visitors by transit will reduce pollutants entering the cave systems and forestall the widening of park roads which are becoming increasingly congested with traffic. Purchase of water for domestic use is recommended to halt the diversion of spring water which is essential to the geologic development of caves and sustains the life forms therein. While the staging area and cross-park road require an irreversible commitment of resources, more people may use the park and enjoy its features without deleterious effect.

4. Alternatives Considered:

Continue present use patterns and "freeze" travel at present level; expand development at present site; several sites considered for peripheral staging area; various sources of domestic water; transit roadbed paralleling existing public roads; one-way motor trails vs. hiking trails; temporary bridge to replace ferries; establishing wilderness now; resource-based cave passage classification system.

5. Comments Requested From:

(Continued on page 2)

6. Date Draft Statement made available to CEO:

April 18, 1974

5. **Comments Requested From:** (Continued from page 1)

Department of the Interior: Bureau of Outdoor Recreation, Bureau of Sport Fisheries and Wildlife, Bureau of Mines, Bureau of Land Management, Geological Survey

Department of Agriculture: Forest Service, Soil Conservation Service

Department of Defense: Corps of Engineers

Department of Transportation: Federal Highway Administration

Department of Commerce: Economic Development Administration

Environmental Protection Agency

Advisory Council on Historic Preservation

Commonwealth of Kentucky: State Clearing House, State Historic Preservation Officer, Barren River Area Development District, County Judge of Barren County, Edmonson County, and Hart County, City Council of Brownsville, Cave City, Horse Cave, and Park City

The Wilderness Society

National Parks and Conservation Association

Sierra Club

National Audubon Society

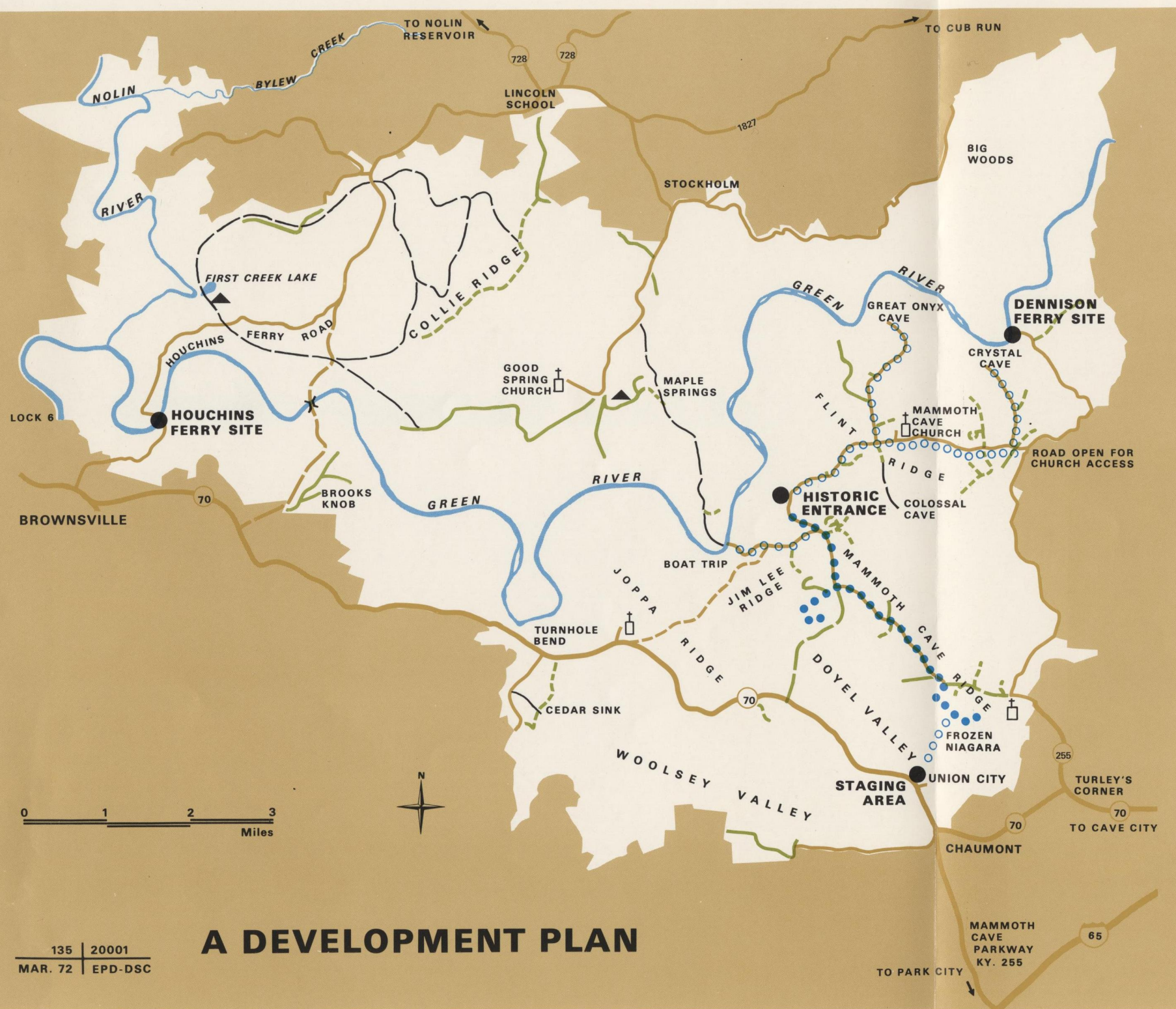
Cave Research Foundation

National Speleological Society

National Park Concessions, Inc.

Miss Green River Boat Concession

Mammoth Cave National Park Association



SITE DEVELOPMENTS

● EXISTING ○ PROPOSED ● EXPAND ○ OBLITERATE

HOUCHINS FERRY SITE

- PICNICKING
- BOAT LAUNCHING
- FISHING
- INTERPRETATION

DENNISON FERRY SITE

- PRIMITIVE CAMPING
- BOAT LAUNCHING
- FISHING

HISTORIC ENTRANCE

- HOTEL & COTTAGES
- CAMPGROUND & STORE
- VISITOR CENTER
- TRANSIT STATION
- TRAILS

STAGING AREA

- PARKING
- ORIENTATION
- TRANSIT TERMINAL

LEGEND

	EXISTING	PROPOSED	OBLITERATE
PUBLIC ROADS			
MANAGEMENT ROADS			
TRANSIT SYSTEM			
TRAILS HIKING			
PRIMITIVE TRAIL CAMPSITES			

DRAFT ENVIRONMENTAL IMPACT STATEMENT PROPOSED MASTER PLAN

For

Mammoth Cave National Park, Kentucky

United States Department of the Interior

National Park Service

Denver Service Center

I. DESCRIPTION OF THE PROPOSAL

A master plan is the conceptual planning document which, consistent with congressional and administrative policies, establishes the guidelines for the overall use, preservation, management, and development of an area in the National Park System. It identifies the purposes of the area; its resource values; its relationship to regional environs; what human needs it should meet; the objectives for its management; management category; a land classification plan; and the general development plan for its management and interpretation. In a sense, these master plans are zoning plans. They define not only the areas for developments; they define also the areas in which no developments are to be permitted.

Preparation of a preliminary draft master plan is the responsibility of an interdisciplinary team of professional planners employed by the National Park Service. Guidelines for their work are contained in the Service's publication titled *PLANNING STANDARDS*.

Before a master plan is adopted, the views of other government agencies, private organizations, and citizens are sought. These and the environmental impacts of the proposals are considered carefully by the Regional Director in which the park is located. He reconciles the various viewpoints and the revised plan is published.

Change occurs constantly, hence master plans must be dynamic documents. They are reviewed and updated periodically else they would be of little value to management officials and technicians in their day to day work. From the master plan, specific action plans are developed dealing with such matters as interpretation, resources management, and design of facilities.

A copy of the preliminary draft master plan for Mammoth Cave National Park is attached. It was completed in December 1970, following two years of intensive study by a team of National Park Service professionals and citizen consultants (see list on page 78 of the master plan). Because of opposition during a series of about 25 informal presentations of the plan, the Service deleted from the proposal a team recommendation that the park be expanded to include more of the land envisioned in the 1926 report of the Southern Appalachian National Park Commission to the

Secretary of the Interior. The Secretary concurred with the Commission's report and Congressional action followed authorizing establishment of Mammoth Cave National Park. Moneys appropriated by the Kentucky legislature and Federal funds, supplemented by donations from citizens, were used to purchase the 51,354.40 acres now in the park. Congress had authorized a park of 70,618 acres as recommended by the Commission.

In the report of the Southern Appalachian National Park Commission, three zones of national significance were recognized within the boundaries of the park it had proposed: Mammoth Cave Plateau containing "extensive limestone caverns," "beautiful" River Valleys, and the Hilly Country with its "rugged landscape clothed in forests" (see drawing on p. 3). The master plan presents a solution to the congestion now occurring at Historic Entrance to Mammoth Cave and seeks to diversify park use by offering new recreational opportunities in the River Valleys and on the Hilly Country. Actions affecting each of these zones are described in turn, along with a description of land and cave passage classification.

A. MAMMOTH CAVE PLATEAU

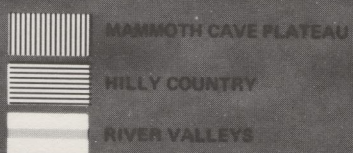
This unit comprises the entire southeast part of the park and contains about 45 percent of its acreage. Most of the land surface is in various stages of forest succession and all of it is underlain by cavernous limestones. Mammoth Cave is one of three major cave systems within the park (see footnote on p. 61).

Adjacent to Mammoth Cave's Historic (natural) Entrance and on the surface above its passages are concentrated virtually all the government and concessioner facilities in the park for the use of visitors and management, including roads, parking lots, visitor center, administrative offices, picnic area, campground, bus loading dock, amphitheater, trail heads, post office, lodgings, food services, curio sales, automobile service station, and the ancillary utility systems.

Some of these facilities predate the park's establishment in 1941, but most were planned in the 1950's, when there were about 200,000 cave visitors per year, and constructed in the 1960's. This was a decade of rapid growth in travel and in 1970, at the end of the decade, visitor entries to Mammoth Cave had climbed to almost 611,000. This is more than three times greater than travel during the 1950's. Hence, the physical plant on the surface over the Historic Entrance is overtaxed, facilities are deteriorating, and park resources are suffering. Both the National Park Service Visitor Use Study, conducted in August 1966, and the master plan team concluded that the quality of the visitor experience is lessening also, as visitation continues to increase.

On the basis of the best information available, it was determined that the number of average daily visits to Mammoth Cave could be increased many fold without having unacceptable deleterious effects on it. Study showed that extending

ZONES FOR MANAGEMENT AND USE



visiting hours would not add significant numbers of visitors. Instead, only an interrelated series of bold actions, spanning 10 to 20 years, would accommodate the increasing numbers of people expected to visit Mammoth Cave. The master plan recommends the following:

- Expand number and variety of cave trips and give visitors a higher quality experience (see 1).
- Relocate the staging area from Historic Entrance to a peripheral site where all visitors' automobiles will be stored while their occupants are in caves, hiking on trails, sightseeing on the Green River, etc. The transit terminal will be located here also (see 2).
- Extend the transit system and transport all visitors to points of interest in the southeast (cavernous) part of the park (see 3).
- Phase out concessioner and Government functions and structures at the Historic Entrance and elsewhere on Mammoth Cave and Flint Ridges (see 4).
- Modify intrapark circulation to provide a roadbed for the transit system; certain roads now open to the public may be closed (see 5).
- Utilize a new source of domestic water (see 6).

Subsequently in this statement, each of these actions will be referenced in the same numerical sequence.

1. Expand Cave Trips

a. **Present Condition*** — During June, July, and August 1970, the operating day was 10-1/2 hours and four trips were available, viz. Historic, Scenic, Frozen Niagara, and Lantern. The first listed was self-guiding with a capacity of 650 persons per hour or 5,525 per day; each trip required 1 to 2 hours, depending on the individual or group. Both the Scenic and Frozen Niagara trips were guided and each was offered six times a day. The Scenic was 4 hours in length with 240 persons per trip or 1,440 per day. The Frozen Niagara trip required 1 hour; capacity was 160 per trip or 960 per day. Two Lantern trips were scheduled with each requiring 3 hours. The maximum was 40 persons per trip or 80 per day. The total daily capacity of Mammoth Cave, if all trips were filled, was 8,005. It should be noted that this is twice the capacity of the visitor center and more than twice the capacity of all the paved parking spaces (see I.A.2.a.).

Cave trips were conducted over 6 miles of trail. The shorter trips of 1- to 2-hour duration were the most popular. Study has shown that the quality of the visitor experience diminishes greatly when there are more

* The term "Present Condition" and the words "now" and "today," as used in this statement, refer to the year 1970 when the master plan was written unless stated or implied otherwise in context.

than 120 persons* on a guided tour. If this number was established as the peak for guided tours in lighted passages, the daily capacity of Mammoth Cave would drop from 8,005 to 7,045. This is still in excess of peak loadings (except for July 2, 1972, when there were 8,013 cave visits) and far in excess of the as-built capacity of the surface facilities, viz. parking lots (3,414) and visitor center (4,000).

Related data concerning visitor use appears in graphic form on page 26 of the master plan report.

b. Ultimate Action — The conservative projection in the master plan forecasts 13,265 average daily cave visits by August 2000. It has been determined that Mammoth Cave could accept, physically, 26,000 average daily cave visits. This can be accomplished by offering several short trips on a frequent schedule after opening new artificial entries, repairing trails, and lighting passages now dark which have been used in the past. Therefore, it is relatively simple to raise the 5,130 average daily cave visits of 1970 to the 13,265 expected in August 2000.

c. Interim Action — Average daily capacity of Mammoth Cave can be built up to meet the August 2000 level in two steps:

Phase I: New Entrance to Mammoth Cave was closed in 1967 because of unstable rock. By replacing this entry with a tunnel (to be constructed), the Frozen Niagara trip can become one-way and semi-self-guiding with a capacity of 500 persons per hour. The Scenic trip could then be offered seven times a day at 120 per trip (total 840) ending with the Frozen Niagara portion being self-guided. The Frozen Niagara trip would be interrupted at 1:00 p.m. and every hour thereafter for a 15-minute break to allow the Scenic trip participants to exit. With this adjustment, the Frozen Niagara tour would accommodate 3,625 daily. The Lantern trips in the Violet City sector would continue with a capacity of 80 per day, but the Historic tour capacity would drop to 5,040 per day because of the time required for the bus ride from the staging area at Union City. Once these steps are carried out, the daily capacity of Mammoth Cave would be increased to 9,585, requiring 1,676 parking spaces. Projected average daily cave visitation is expected to reach this level in August 1986.

* See report of National Park Service Visitor Use Study conducted from August 14-20, 1966 in the park's files.

Phase II: By lighting the passages now used for the Violet City Lantern trip and providing a pair of elevators into Star Chamber from the present campground, 120 visitors could enter through the Violet City Entrance every 15 minutes or a total of 3,960 per day. To replace the Violet City Lantern Tour, four hand-lighted trips of 25 each could visit Great Onyx Cave on Flint Ridge for a total of 100. Thus gross daily cave capacity becomes 13,565, which is 300 greater than the anticipated 13,265 average daily cave visits by August 2000. For a visitor load of this magnitude, 2,320 parking spaces would be required, thus achieving ultimate development of the parking lot at the staging area envisioned in the draft master plan (see I.A.2.b.).

When warranted, Mammoth Cave's capacity can be increased further by providing other tunnel or elevator entries and redeveloping other passages. Additionally, formerly developed passages in the front portions of Colossal and Crystal Caves may be used for lantern trips with up to 40 persons per trip on a semi-wildcaving experience.

2. Relocate Staging Area to a Peripheral Site

a. Present Condition — The staging area at Historic Entrance was built to accommodate smaller numbers of people than the present visitor load. Capacity of the parking lot is reached when there are 3,414 visitors per day in Mammoth Cave. From June 13 to September 7, 1970, there were more than 3,400 each day except for the period between August 30 and September 5 when there were fewer. The latter period was the first week of school. On 12 days, between July 1 and September 7, cave visits exceeded 6,000 including July 4 when there were 6,501 and September 6 when there were 6,729. Thus, it is apparent that the parking lot overflowed almost daily through the 1970 season. Travel is continuing to increase and a reasonable forecast predicts 13,265 average daily cave visits in August 2000, compared with 5,130 in August 1970.

The visitor center at Historic Entrance is now the transit terminal. Its facilities are crowded when there are 4,000 cave visitors per day. As noted in the preceding paragraph, this was of regular occurrence during the 1970 visitor season, and this trend is continuing.

b. Ultimate Action — The draft master plan calls for relocating the staging area to the periphery of the park at a place called Union City on early park maps. This site is 3/4 mile inside the main park entrance at Chaumont, which is at the junction of Mammoth Cave Parkway (Ky 255) from Park City and Ky 70 from Cave City. Both roads carry two lanes of traffic. Park City and Cave City are communities on Interstate

65. In time, traffic will require widening the segment of Ky 70 within the park (3/4 mile) from two to four lanes with a median, and providing an interchange at the entry to the staging area to carry the volume of traffic expected well before the year 2000 visitor season.

Union City, the area designated in the master plan, was a cluster of 5 or 6 homes (none remain now) and farmland before the park was established. It is a nearly level tract of 30-35 acres, mostly broomsedge fields with tangles of briars and scattered thickets of hardwood and cedar trees in various stages of forest succession.

Wet weather swamps flank part of the tract and testify of the impervious Haney limestone, weathered to clay, which underlies the site. This is underlain in turn by the Big Clifty sandstone, 50 to 60 feet thick, also impervious. In the spring, water overflowing from the swamps at Union City follows natural surface channels for short distances and then drops into swallow holes at the bottom of sinks or enters fissures and drops into the conduits dissolved in the cave-bearing limestones beneath the sandstone. Meteoric water, likewise, after seeping into the ground, moves outward to the perimeter of the ridge and enters the limestone.

No cave passages are known directly beneath the site, but there is a strong probability they do exist. Bluff and Proctor Caves are nearby. The former is very small and the latter is less than a mile long. About 1,000 feet of Proctor was developed with trails and shown commercially prior to the park's establishment.* Even though cavernous limestones may be beneath the Big Clifty sandstone, it will bear any loading proposed for it in the plan, according to the Geological Survey.

At the staging area, the plan contemplates a tree-shaded parking lot for a maximum of 2,320 vehicles, covering about 30 acres, which will bring an average of 13,265 cave visitors to the park expected in 2000, two and a half times more than the visitors recorded in August 1970. It is assumed that the family automobile will continue into the foreseeable future as the basic transportation vehicle. On the north side of the parking area there will be a terminal building from which visitors will board transit vehicles for cave trips, trail heads for hikes, and the sightseeing boat trip on the Green River. The building will contain

* Exploration beyond the developed portion of Proctor Cave by the Cave Research Foundation in September 1973 has extended its passages both easterly and westerly. The former are beneath the proposed peripheral staging area.

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space for visitor orientation, restrooms, ticket, food, and curio sales, nursery, kennel, and a ranger station. Adjacent to the terminal will be a loading dock for transit vehicles. The transit terminal has not yet been designed. It is anticipated that it will be built sometime between 1980 and 1985.

Water may be purchased from districts formed outside the park, or the National Park Service may establish and operate its own plant for treating Green River water. Sewage may be piped and treated at the existing plant near the Green River, or it may be treated onsite and only the effluent piped to the Green River plant. These decisions await more detailed engineering studies at later stages of planning.

c. Interim Action — Embark (as soon as funds are available) upon the first stage of parking lot construction by providing space for the 7,600 average daily visitors expected in August 1979. Units of parking will be added as needed until the ultimate capacity is reached.

During the first years of operation, the staging area will function during the heavy travel season of June, July, and August and at peak periods at other times of the year. It is expected that ultimate parking lot size, full all-year functioning of the staging area, and widening of Ky 70 will be completed between 1985 and 1990.

Restrooms and possibly a rain shelter adjacent to the bus loading dock is all that will be required for the use of visitors while the first stage parking lot is in operation. These will be temporary structures until the transit terminal, described above, is needed. Meanwhile, visitors will be bused directly from the new staging area to the visitor center at Historic Entrance which will continue to function for orientation/information, ticket sales, and ranger station, and the concessioner will continue to provide food services and lodgings as at present.

3. Extend Transit System

a. Present Condition — National Park Concessions, Inc. now operates eight 40-passenger and two 33-passenger buses* from Historic Entrance to and from other cave entrances on Mammoth Cave Ridge for which a fee of \$.50 per person (except small children) is charged. About 44 percent of the visitors use this service. Bus schedules are delayed often because these vehicles must use, in part, the same roads as do visitors' cars (see footnote on page 104).

* Two 40-passenger buses were added to the fleet in 1972.

b. **Ultimate Action** — When the peripheral staging area is fully operational, the transit system will occupy a roadbed of its own and transport all visitors to their destinations in the southeast part of the park. It is anticipated that the existing roadways on Mammoth Cave and Flint Ridges will be utilized wherever possible by the transit system. Doyel Valley can be crossed generally on the alignment of the old road between Union City and the New Entrance Hotel site. It is not known now whether buses, minitrains, monorails, or what kind of system will be used to transport the visitors.

c. **Interim Action** — Upon completion of the first stage parking lot, visitors will be asked to ride concessioner shuttle buses to the visitor center at Historic Entrance 5.5 miles over existing roads. Upon arrival there, visitors will walk to the natural entrance for the Historic Tour or ride a bus to other cave entries, as at present. The only parking for personal cars at Historic Entrance, during this interim period, will be by those who have lodgings or are in the campground or picnic area. To avoid criticism, it may be necessary to bus these visitors also, except for campers who must have their vehicles.

4. **Phase Out Existing Facilities**

a. **Present Condition** — The following facilities are located above cave passages and in the vicinity of the Historic Entrance to Mammoth Cave (see scaled drawing on page 11):

(1) **Government:** Paved parking for 597 cars and buses; bus loading dock; brick visitor center containing space for visitor orientation/information, restrooms, ticket sales for cave, bus, and sightseeing boat trips; brick administrative office structure; concrete arch bridge between visitor center and hotel; roadways; network of foot trails on the Green River bluff; paved and lighted path to Historic Entrance; picnic area for about 75 parties and comfort station; 145-site campground fully equipped; and an amphitheater. Most of these were constructed as MISSION 66* projects and cost about \$920,000.

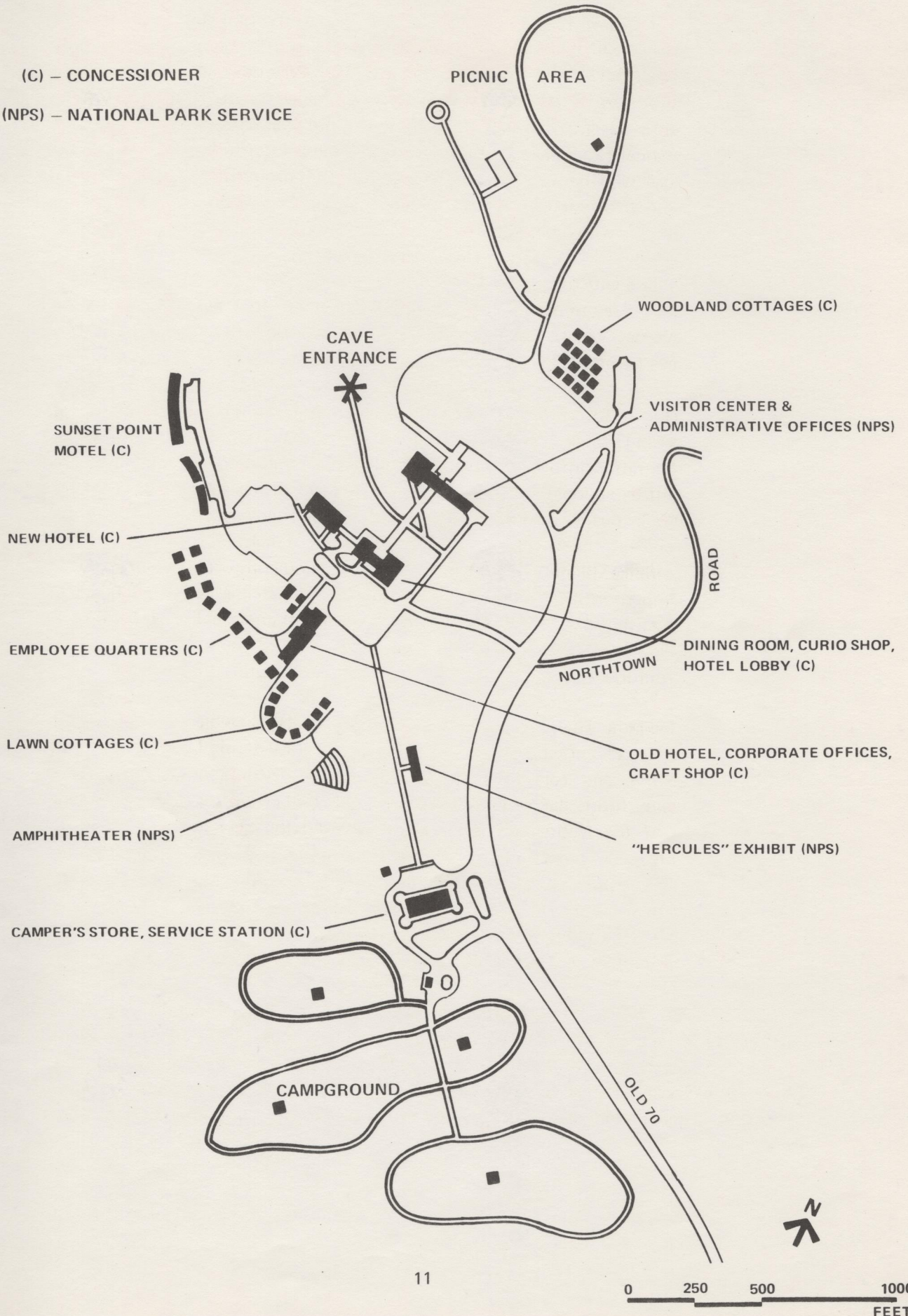
(2) **Concessioner:** 500 beds located in 158 rooms in a variety of structures (old hotel, 46 rooms; new hotel, 38; Sunset Point Motel, 20;

* MISSION 66 was a 10-year program, inaugurated in 1956, which provided the resources to bring each National Park Service area up to a consistently high standard of preservation, staffing, and carefully controlled physical development. During the preceding war years, funds had not been available for domestic programs. Renewed interest in areas of the National Park System prompted the Service to meet these needs.

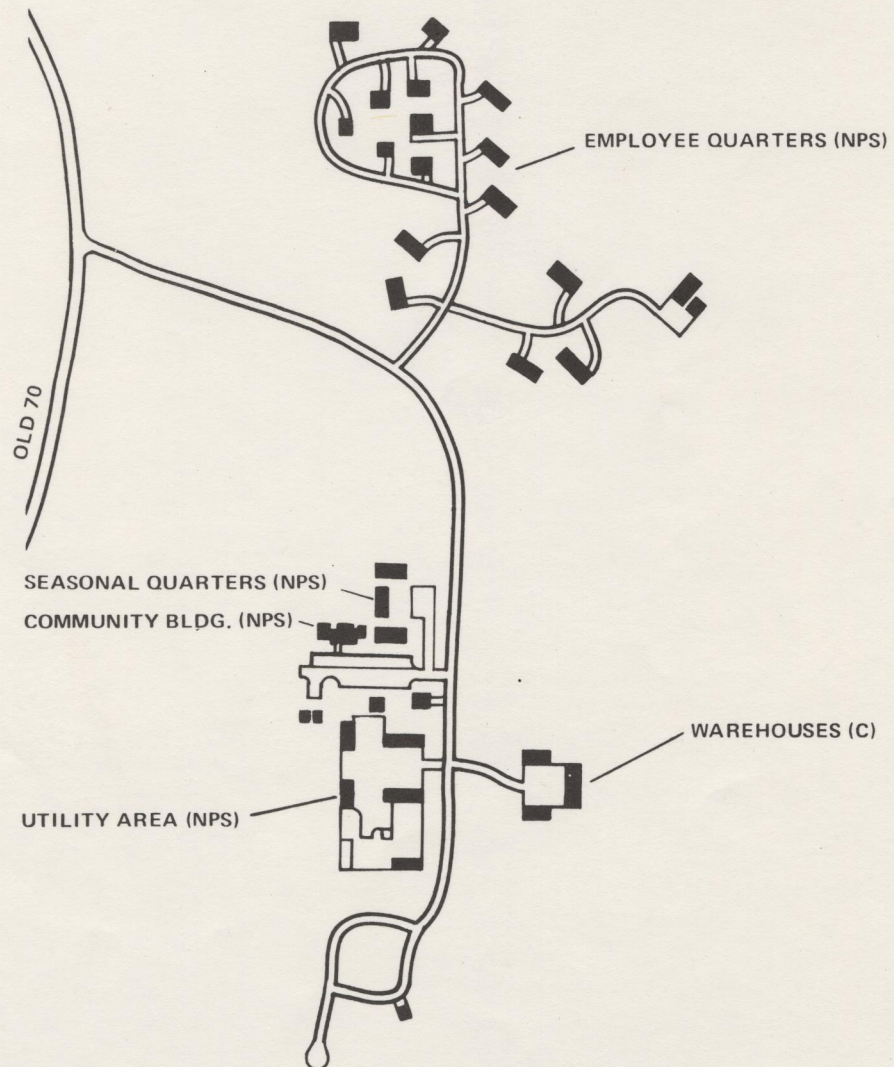
HISTORIC ENTRANCE AREA

(C) – CONCESSIONER

(NPS) – NATIONAL PARK SERVICE

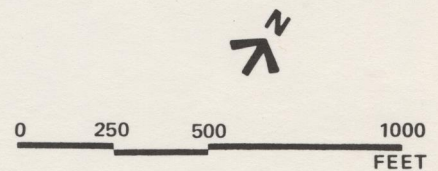


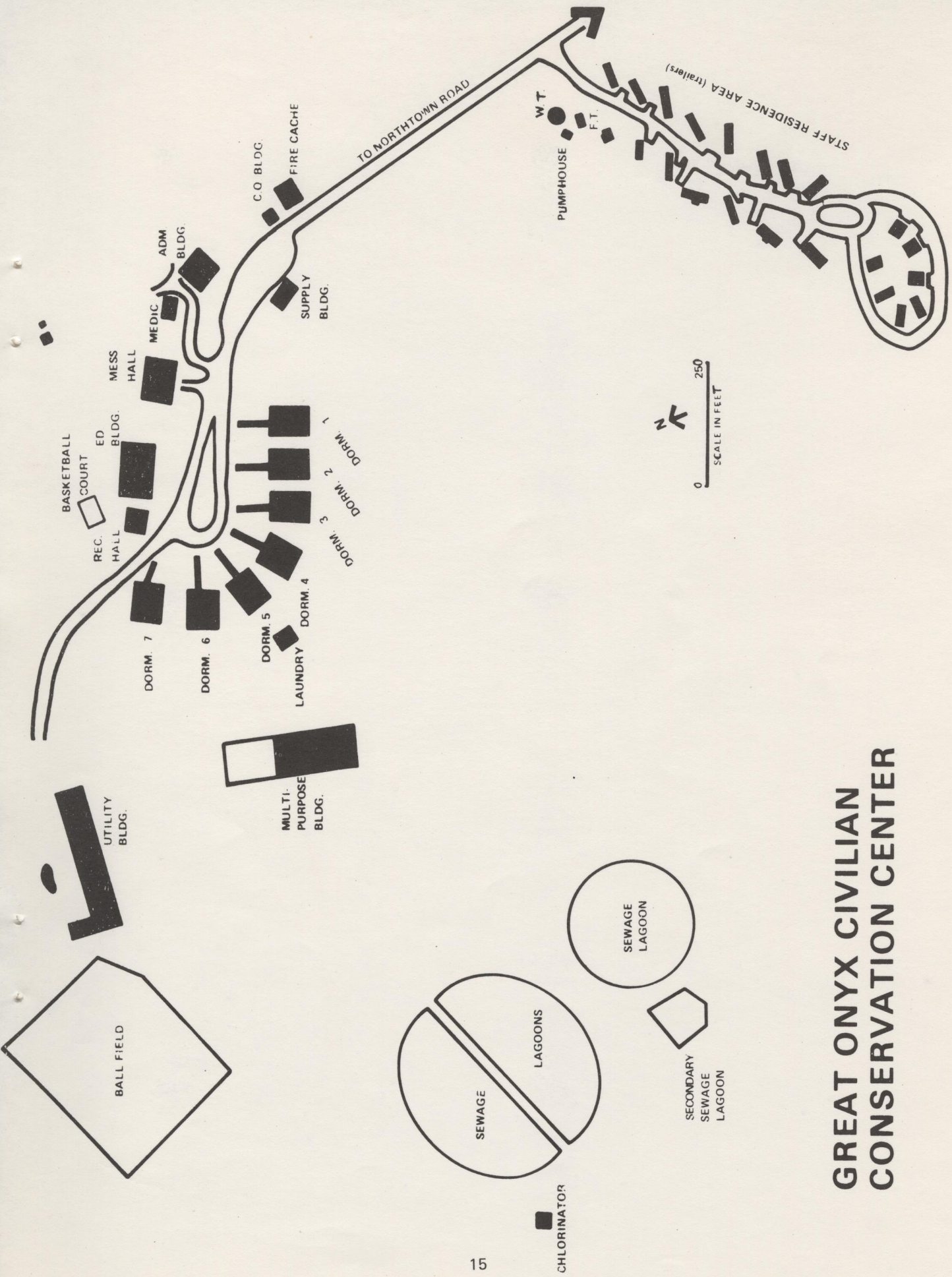
GOVERNMENT & CONCESSION "HOUSEKEEPING" AREAS



(C) - CONCESSIONER

(NPS) - NATIONAL PARK SERVICE





GREAT ONYX CIVILIAN CONSERVATION CENTER

lawn cottages, 10; woodland cottages, 40; huts, 4); dining room seating 190; coffee shop with 65 seats; curio and craft stores; hotel lobby and offices; auto service station; building containing grocery store, shower room, laundry room, and post office; and employee quarters. Of these, the old hotel, lawn cottages, woodland cottages, huts, and employee quarters are wood frame structures many years old, some predating establishment of the park. The newer masonry structures were built by the concessioner towards the end of the MISSION 66 period and his investment is about \$500,000. The older buildings are Government-owned.

The following structures are located in the housing and utility areas on Mammoth Cave Ridge about a mile east of Historic Entrance (see scaled drawing on p. 13):

(1) Government: 20 employee quarters, community building, four warehouse and shop buildings, gasoline service station, three equipment storage sheds, unused incinerator, with associated paved roadways and paved parking lots. Of these structures 11 were built by the Civilian Conservation Corps, 12 were MISSION 66 projects, and seven have been part of the training program of the Great Onyx Civilian Conservation Center. These structures were built at a cost of about \$320,000.

(2) Concessioner: three warehouses and paved parking lot. Two of these structures were built during the Civilian Conservation Corps period and one is a current Great Onyx Civilian Conservation Center project.

On Flint Ridge, the Great Onyx Civilian Conservation Center, 214-man capacity, comprises the following buildings on a 40-acre site (see scaled drawing on p. 15):

Dormitories (7), education, administration, dining hall, dispensary, guidance and counseling, utility, supply, PX and quiet lounge, charge-of-quarters, laundry, multi-purpose, firehouse, and chlorinator house. Housing for supervisory staff is in a trailer village with 18-20 units. There is a water storage tank, three sewage lagoons and effluent pipe to the Green River, a ball field, associated roadways, and sidewalks. All main buildings were completed by June 1965, and the value of the facilities is about 1.5 million dollars. Most buildings are of temporary, mobile construction. The site had been occupied previously by a Civilian Conservation Corps Camp, but all structures used in that program had been razed years before the Center was established.

b. **Ultimate Action** — The draft master plan calls for the removal of the Great Onyx Civilian Conservation Center and the restoration of the site to its natural condition. Similarly, Government and concessioner facilities on Mammoth Cave Ridge are to be removed and the area occupied by them restored, but with some exceptions. Certain roadway clearings may remain for the transit system and a transit station will be located at Historic Entrance to provide shelter for visitors waiting for transportation after returning from a cave trip or from hiking the existing trails along the Green River bluff. An estimated 47,586 hikers used this 5-mile trail system in 1967. The station is envisioned now as a modest, unobtrusive structure for about 50 people to get out of the weather. Summertime thundershowers are often severe and sudden, and wintry blasts require some shelter. The structure will be cooled and heated according to season, and will contain restrooms, perhaps a food and beverage vending machine, if warranted, and a lounge area for cave guides. The paved and lighted trail will remain to Historic Entrance. Otherwise, the area will resemble eventually its appearance c. 1800.

About a half mile away, in the present campground and out of sight of Historic Entrance, there will be a transit stop adjoining the elevator house which will serve Star Chamber.

c. **Interim Action** — Before any existing facilities or services are phased out, initial development must begin at the peripheral staging area. After utilities are brought in, the first-stage parking lot, a temporary comfort station, bus loading dock, and rain shelter can be built. Progress on this and the ultimate development will depend on rate of funding by Congress, but this is expected to be accomplished within 10-20 years following approval of the master plan.

Meanwhile, neither Government nor concessioner will expand at Historic Entrance, but will continue maintenance and may make improvements to facilitate interim operations like remodeling the visitor center or the dining room. The concessioner's investment in improvements, however, would be planned for amortization by 1988 with his other properties. Further, any compensation due the firm under its contract, or by law, will be paid during the period of adjustment to the new site.

The phase out will be accomplished in an orderly manner giving both Government and concessioner opportunity to observe operations in advance of full implementation of the peripheral staging area. For a time, both will be operating duplicate facilities.

Subject to the availability of capital resources, the National Park Service will carry out the foregoing plan as described below:

**PHASING OUT AND
DEVELOPMENT
OF FACILITIES**

Phase Out	Time Unit*	Development
No expansion at Historic Entrance; perform essential maintenance; concession investment limited to adjustments of current operations to be amortized by 1988.	1	Bring utilities to staging area; open new cave entryway and associated facilities
Same	2	Develop parking for cars at staging area; bus visitors to Historic Entrance; build Green River Bridge and connecting road; build transit roadbed across Doyel Valley.
Close NPS parking lot at Historic Entrance and Joppa Ridge Motor Nature Trail	3	Construct transit terminal building and transport visitors to all cave entrances, boat trips and trailheads; petition court to amend road deed; abandon ferries;
Close and dismantle NPS and Concession facilities at Historic Entrance	4	Continue operations at staging area; open new cave entryways and associated facilities; build shelter at Historic Entrance.
Phase out and dismantle NPS housing and utility area on Mammoth Cave Ridge	5	Improve facilities at Houchins and Dennison Ferry Sites.

* A time unit could be a period of from five to ten years depending on public demand for facilities and services and Congressional limitations on funding and staffing.

Phasing out of facilities and services at Historic Entrance and phasing in at the peripheral staging area will be an orderly process requiring 10 to 20 years for completion, depending on increasing visitation and funding of projects. See chart on p. 19.

5. **Modify Intrapark Circulation**

a. **Present Condition** — There is a network of paved roads in the southeast part of the park including a 7.7 mile segment of a State highway (Ky 70) which serves transpark and intrapark traffic. There are public and management roads to park features and facilities, both paved and unpaved. All existed prior to the park's establishment.

The National Park Service is required by deed reservation to keep some of these roads "open for the usual use by the public."

Segments of some of these roads are used by visitors' cars and by buses which carry cave parties to and from various entrances. For some visitors this amounts to four trips on the same roadway resulting in unnecessary traffic congestion and bus schedule delays.

The Joppa Ridge Motor Nature Trail, 2 miles in length between the Mammoth Cave Ferry Road and Ky 70 at Joppa Church, is a special single-lane interpretive road. It is self-guided with 13 stations keyed to a printed guide folder available at the start of the trip.

b. **Ultimate Action** — Once the peripheral staging area is ready to operate and Historic Entrance facilities are being phased out, the expanded transit system will go into operation. Then all visitors will use it to reach their destinations — cave entrances, trail heads, sightseeing boat dock — in the southeast part of the park. Whatever transit system is used then — bus, minitrain, monorail, etc. — will operate on a roadbed of its own with a recorded message delivered en route explanatory of park features seen or to be seen. At this point in time, all personal vehicles will be parked in the peripheral staging area (see I.A.2.b.). The existing road alignments will serve as the route of the transit system, wherever possible, to preclude cutting more timber and making new clearings in the forest. Then the National Park Service will petition the court to amend the road deed so that affected roads may be closed and used by transit vehicles only.

Persons desiring to attend church services or visit cemeteries may continue to do so, though the route of access may differ somewhat from that used today.

The transit system will cut off private car access to the Joppa Ridge Motor Nature Trail, so this interpretive feature will be discontinued at that time. The trail does not follow a route covered by deed reservation.

c. **Interim Action** — Roads will not be closed prior to development of the ultimate transit system between 1985 and 1990. Present bus routes will continue and shuttle buses will be provided between the peripheral staging area and Historic Entrance (see I.A.3.c.) over existing roads during the summer vacation period and busy periods at other times of the year. Access to churches and cemeteries and use of the Joppa Ridge Motor Nature Trail will not be affected in any way until the transit system is in full operation.

6. **Utilize New Source of Domestic Water**

a. **Present Condition** — The springs emerging from the perched aquifer in the Haney limestone on Flint Ridge are now the major sources of domestic water used in the park. It is of high quality because almost all of Flint Ridge is in the park and pollution sources are virtually non-existent. This same high water quality is essential to the perpetuation of the cave fauna and continued geologic development of the cave system. Spring water is supplemented by water from wells which is high in sulfates. Both sources are barely adequate to meet present requirements for water in the park.

Water use by the Great Onyx Civilian Conservation Center is about 7,200,000 gallons annually; by the concessioner 6,750,000 gallons annually; and all other uses (campground, visitor center, public comfort stations, park residences, and utility area) 13,230,000 gallons annually, or a total of 27,180,000 gallons.

b. **Ultimate Action** — Eventual restoration of full water flow into the caves from the springs on Flint Ridge and abandonment of the wells is anticipated in the master plan so that natural conditions will be re-established. Major water use will shift then to the peripheral staging area where, by August 2000, 13,265 daily average cave visits are expected. Other water users will be the three comfort stations in Mammoth Cave and the proposed Historic Entrance Transit Station. The combined average daily cave visits at these is estimated at 11,000 in August 2000.

If staging area visitors used 10 gallons per day and comfort station users each required 5 gallons per day, total water demand during August 2000 would be somewhat less than 6 million gallons. During August

1970, park water use was recorded as follows: 1,308,930 gallons Job Corps; 1,187,560 gallons concessioner; 2,796,690 gallons all other; or a total of 5,293,180 gallons for the park. Early phasing out of the Great Onyx Civilian Conservation Center will release considerable water for other park uses and provide time necessary for planning and building facilities to replace the present collection system.

c. **Interim Action** — The National Park Service has concluded that it would be less expensive to buy water from one of the districts on the park's periphery than to tap the Green River and build and operate a treatment plant in the park. Either the Edmonson or Green River Valley Water Districts have adequate supply and treatment plant capability to meet the park's needs. A third district is being planned in Barren County. In either case, water would be piped to the park boundary from where it would be connected to the park's own distribution system. Since the major use in the future will be at Union City, it will be necessary to extend the pipeline across Doyel Valley. Negotiations are under way to obtain water from one of these sources.

B. RIVER VALLEYS

The Green and Nolin River Valleys comprise the second of the three zones of the park. A 26-mile segment of the Green bisects the park from east to west and a 6-mile segment of the Nolin flows into the Green from the north and is generally parallel to the park's west boundary. The rivers meander in deep valleys and some bluffs rise 100-300 feet above them.

Green River forms a natural barrier to north-south travel. Two roads cross the park in this direction, however, and each has a ferry operated by the National Park Service without fee. These roads and ferries are to remain open for the "usual use by the public" in accordance with the 1945 road deed. The ferries are used by local people commuting to work, for shopping, and for access to churches and cemeteries in the park; by park employees traveling on business; and by park visitors. Perimeter roads outside the park have been improved significantly over the years and many local people now find that they can reach their destination quicker, safer, and with less wear and tear on car and driver without using park roads.

As many as 3,000 people, it is estimated, bring their boats on trailers each year and launch them at the ferry ramps to go sightseeing or fishing. Small motorboats, up to 10 horsepower, may be used on the slackwaters, but only hand-propelled boats may be used on the 9-mile, free-flowing section of the Green at the east end of the park. The sole exception to these boating standards is the specially-designed sightseeing boat, "Miss Green River," which carries 122 passengers. Trips originate from a dock just downstream from Mammoth Cave Ferry. This boat, operated by a concessioner, carried 85,000 patrons in 1970.

The Green River, being subject to 50-foot flood crests, has steep banks of alluvium which are very muddy and slippery most of the time. A narrow bench forms the floodplain at the three ferry sites. Floods are most likely to occur in April, but may come anytime. Hence, it is not practical to construct permanent structures on the floodplain.

The Green and Nolin provide much opportunity for solitude and enjoyment of nature's handiwork and creatures. Sightseeing and fishing by boat are compatible recreational uses which will continue.

As public use increases, the draft master plan recognizes that it will be necessary to add certain simple facilities.

7. Provide Additional Sites for Picnicking and Primitive Camping

(for the purpose of cross-reference, actions are numbered sequentially from 1 to 10, inclusive, throughout this statement).

a. **Present Condition** — Houchins Ferry is located on a 6.5-mile transpark road extending from near Brownsville on the south to Ollie at the north park boundary. It is a gravel road one to two lanes in width. In addition to the ferry and its ramps, there is a small development on the south bank consisting of a picnic area with six to eight tables, drinking fountain, two pit toilets, and roadside parking for six vehicles. The ferry operator has a warming shack with electric light and heat.

Mammoth Cave Ferry is on a road 5.75 miles long between Mammoth Cave Ridge on the south to near Stockholm on the north park boundary. The 1.2-mile section from the ridge to the south bank is paved and two lanes wide; and 4.5 miles north of the river is gravel and mostly one-lane wide. Again, in addition to the ferry and its ramps, there is development only on the south side consisting of a parking lot holding 60 vehicles and the sightseeing boat dock. The lot cannot be expanded because it is hemmed in by steep slopes, the ferry road, and the Green and Echo River channels.

Dennison Ferry, near the east park boundary, is reached over a 1.6-mile, single-lane gravel road, impassable in wet weather. The park road leads off of a single-lane, gravel, county road along the park boundary. A mile or two of the county road east of the park towards Northtown was rebuilt, widened, and paved within the past two years and a similar standard exists all the way to Horse Cave on I-65 about 4 miles farther. Nothing remains of the old ferry operation but the road

ends in a cul-de-sac on the floodplain where fishermen who have recreation vehicles stay overnight occasionally. No water or sanitary facilities* have been provided. The site is very muddy when wet.

No campsites for boaters have been provided yet (1970), in the River Valley, because few float down or paddle up the river for a distance requiring an overnight stay along the way.

b. Ultimate Action — At Houchins Ferry, the picnic area on the south bank will be doubled in size to accommodate as many as 12-15 parties. Simple interpretive devices are to be installed and are to be designed for removal at flood times. On the north bank, a picnic area of eight to ten sites appears feasible, and a small spring nearby could be tapped for drinking water. Sanitary facilities suitable for use on the floodplain will be provided. The concrete ferry ramps will continue to serve for boat launchings. The existing gravel road, 12 feet in width, will remain and dust pollution will be controlled by surface treatment with a neutral wetting agent. Traffic volume is not expected to increase beyond the capacity of such a low-standard road.

At Mammoth Cave Ferry, the parking lot will become a transit stop for *Miss Green River* passengers who will be transported there from the peripheral staging area. Boat launching here will be discontinued at that time as will the transpark road and ferry (see I.C.8.b.). This will be accomplished between 1985 and 1990.

At Dennison Ferry, expand space on the floodplain for primitive camping and provide sanitary facilities. Water from a small spring upstream, draining from a bluff along the river, might be piped to supply drinking water if tests are satisfactory. Planks with cleats or a set of wood steps will be laid on the muddy river bank to facilitate launching of hand-propelled boats and embarking and disembarking from them. No motorized boats are to be used in the 9-mile section of Green River which is free flowing and adjacent to Dennison Ferry.

As the outstanding riverscapes along the Green and Nolin become better known, float trips will become more popular with overnight stays en route. Then one or several of the larger and higher river islands on the Green will be designated for camping and there is a good site at First Creek Lake on the Nolin. Fire circles and toilets of approved design will be installed when warranted. Ample driftwood is available for cooking fires.

* Two chemical toilets were placed here in June 1973.

c. **Interim Action*** — Expand facilities first on the south bank at Houchins Ferry; then on the north bank when needed. Space available will constrict size of ultimate development. For example, a swamp at the mouth of Dry Branch just upstream on the south bank will not allow expansion of the picnic area eastward.

No further development will take place at Mammoth Cave Ferry, though visitors who have left their cars at the peripheral staging area will be bused from the visitor center at Historic Entrance for the sightseeing boat trip.

At Dennison Ferry, action towards ultimate development should start soon with the idea of completion in 5 to 10 years. Upgraded maintenance will prevent the road from washing and correct the drainage problem in the camp area on the floodplain.

The primitive campsite at First Creek Lake should be developed in the near future since it could serve boaters as well as hikers.

C. HILLY COUNTRY

This is the third zone of Mammoth Cave National Park and comprises about 40 percent of its total acreage. It is the seldom visited backcountry north of the Green and west of Turnhole Bend south of the Green. Most of the land is forested, though extensive areas which had been cultivated are still old fields, not yet reverted. Those willing to explore it will find attractive geologic formations, waterfalls, and abundant wildlife. The best seasons, because of pleasant temperatures and lower humidity, are spring, when the forest is carpeted with wildflowers, and autumn, when the forest is ablaze with colorful foliage. Hikers need to be aware of the presence of copperheads and rattlesnakes in summer, though these are not considered to be abundant, but ticks and flies are pests.

At this time, the Hilly Country is virtually inaccessible to visitors because the Green River is a natural barrier to transpark traffic. The ferries and dust-choked roads are, in a sense, built-in controls which limit travel across the river. Once across the Green, trails are virtually nonexistent, for the National Park Service has

* During 1971, as an experiment to encourage more use of the River Valleys, 12 primitive campsites were designated on the south bank at Houchins Ferry; there was improved maintenance on the Dennison Ferry road including the cul-de-sac in the camping area on the river bank; 12 islands in the Green River were designated for primitive camping, on each a 40-foot square site was cleared of undergrowth, and a fire circle was outlined with rocks; and a site was cleared at First Creek Lake. Rangers issued during 1972 about 50 campfire permits covering about 300 persons using the islands and First Creek Lake sites.

not felt that use would warrant providing them. A few hikers and horseback riders, however, do use old farm roads which have been maintained as management roads, but these do not serve points of scenic interest. Cross-country travel is most difficult because of dense undergrowth.

The park's forests and rugged topography were recognized by the Southern Appalachian National Park Commission as being assets of national significance, hence the master plan recommends that this area be made more accessible. The master plan, however, contains provisions for protecting the natural values of the area. Nothing in this plan for the Hilly Country cuts off access to Good Spring Church or the cemeteries now reached by public roads.

The draft master plan proposes the following actions:

- Replace ferries with bridge and new transpark road (see 8).
- Establish trail system (see 9).
- Develop primitive campsites (see 10).

(Again, the numerical sequence of these actions follows that on page 5 and 24.)

8. Build Transpark Road and Bridge

- a. **Present Condition** — Two outdated ferries, Mammoth Cave and Houchins, carry up to three vehicles (passenger cars or light trucks) per trip across the Green. Capacity is 15-18 vehicles per hour in each direction. Service is available daily from 6 a.m. to 11 p.m. (April to November 15) and 6 a.m. to 10 p.m. the balance of the year except in times of flood, which occur usually in April but which may occur sporadically from April through September. The ferries close during periods of high water, because of danger from floating objects like tree trunks and large limbs.

Mammoth Cave Ferry transported 1,912 vehicles, carrying 3,588 passengers in January 1970, and 4,856 vehicles with 12,102 passengers in August 1970. Traffic in January can be presumed to be almost entirely commuter and park employee use. In summer, up to a third of the total crossings are visitors' vehicles.

Traffic over Houchins Ferry is a fraction of that over Mammoth Cave Ferry. The operator recorded 352 vehicles carrying 674 passengers during January 1970; in August 1970 there were 1,134 cars and 2,736 people. Virtually all this traffic is by local residents and park personnel. Visitor travel in summer is up to 20 percent of the total.

Assuming an average for the year of 25 percent visitor travel for the total crossings on both ferries, fewer than 31,000 park visitors viewed the Hilly Country in 1970 compared with total park travel of 1.7 million and cave entries of 611,000. While the National Park Service provides the ferries without fee, the annual operating costs exceed \$60,000 or about \$1.00 per vehicle crossing in 1970.

At Mammoth Cave Ferry, traffic backups occur frequently during the busy part of the day in summer. Congestion results from the low capacity of the ferry, traffic in and out of the parking lot by sightseeing boat patrons, and competition with the ferry by boat launching at the ramp. Cars with boat trailers must park along the edge of the pavement, so their maneuvering adds to the congestion. Cars with trailers attached can seldom board the ferry because the angle of the approach road is too steep for the flexibility of the hitch. No data is available to quantify the foregoing situations.

Congestion also occurs daily, except Sundays, all year at Mammoth Cave Ferry during the morning and evening commuting periods, viz. 6:30 to 8 a.m. and 4:45 to 6 p.m. Frequently as many as five cars are waiting to cross. The ferry's capacity is three vehicles and about eight minutes are required for a round trip. The waiting period is often from 12 to 15 minutes.

b. Ultimate Action – Close the two ferries and the Mammoth Cave Ferry Road, in part, and replace the ferries with a bridge and new transpark road. The master plan suggests the location of a corridor to contain this road from the south park boundary near Brooks Knob to the north park boundary at Ollie, a distance of about 5 miles. About a mile of additional right-of-way across private land would have to be acquired between the south boundary of the park and Ky 70 near Arthur. Arthur is about 2.5 miles east of Brownsville and Ollie about 8 miles south of Nolin River Lake. The transpark road would tie closer together the compatible, yet diverse, recreational resources of the Corps of Engineers' reservoir and Mammoth Cave National Park.

This corridor across the park appears feasible from a map study only. Wherever possible, existing roads, including a portion of the Houchins Ferry Road north of the river, would be used. The new road would be designed to "lay lightly on the land." It would be classed as a minor park road with a pavement width of 20 feet and 3-foot shoulders, 35-mile design speed, and would carry passenger cars and buses, but no commercial traffic. Without on-site engineering studies, it is impossible to determine the type of bridge to be built except to say that it will

have to be high enough to clear anticipated flood waters of the Green River. Necessary data for the proposed crossing can be supplied by the U.S. Geological Survey and Corps of Engineers.

Two parking areas for hikers' vehicles will be provided north of the Green where trails intersect this transpark road (see I.C.9.b.). These lots need to be large enough to accommodate about six private cars and a couple of school buses.

Those portions of the Houchins Ferry Road that remain will continue as a minor gravel road with present alignment and width of 12 feet with 2-foot shoulders. Application of a neutral wetting agent will lessen dust rising with passing traffic. This road will provide access to the picnicking and boat launching facilities planned adjacent to the ferry landings on both sides of the river. A parking lot for hikers' and fishermen's vehicles will be built near Temple Hill Cemetery for those going into the Nolin River Valley and to First Creek Lake.

c. Interim Action — Obtain an amendment to the road deed to allow closing of the Mammoth Cave Ferry Road between its junction with the Good Spring Church Road and the road system on Mammoth Cave Ridge, and to permit the discontinuance of Houchins Ferry.* These actions would clear the way for building the new bridge and transpark road.

9. Establish Trail System

a. Present Condition — No trails have been built in the Hilly Country. A fisherman's foot trail has developed through repeated use between the Houchins Ferry Road at Temple Hill Cemetery and First Creek Lake. This is about a mile in length and is steep and narrow. Occasionally hikers (no use figures available) travel the management roads, and in 1970 there were about 100 people who rode horses over some of these roads.

b. Ultimate Action — Establish a primitive trail system, about 20 miles long, from parking areas along the transpark and Houchins Ferry roads into the valleys of the Nolin River and the Wet Prong of Buffalo Creek, and to Maple Springs. Trails will not penetrate "basin ecosystems" selected for study. These are watersheds, 150 feet or more in depth, and self-contained within the park. Wherever possible, old farm roads will be incorporated into the trail system. The 3.1-mile

* This ferry might continue to operate seasonally as a "living history" exhibit.

segment of the Mammoth Cave Ferry Road between Good Spring Church Road and the Green River will become a trail.

It is anticipated that use of these trails could easily build up in 5 to 10 years to the point where widening and surfacing would be necessary. The latter is because of highly erodable soil.

c. **Interim Action*** — Laying out and constructing a trail system is unwarranted until after the transpark road and bridge are built. Use would be too light for the investment with the present ferry crossings and low-standard roads.

10. **Develop Primitive Campsites**

a. **Present Condition** — No primitive campsites had been designated or developed by 1970 because requests for such facilities had been so infrequent.

b. **Ultimate Action** — Establish a primitive campsite(s) for boatmen and backpackers at First Creek Lake in the Nolin River Valley to include a shelter or two, sanitary facilities, and a fireplace. Here again use could reach the point that public health requirements could be met only by providing flush toilets.

At Maple Springs, several shelters could be built. Space is adequate and plentiful and potable spring water is available. An environmental study area for group use could be established here. Maple Springs is about a 4-mile hike over a proposed trail from Ollie, and about 2 miles from Stockholm. Both Ollie and Stockholm are on the north boundary and are reached over county roads.

c. **Interim Action**** — Because First Creek Lake is accessible by boat, establish that campsite first. Add another there, and establish the site at Maple Springs when the trail network is built and demand for facilities is established. Even though the Maple Springs area is accessible by the low-standard road from Stockholm to Good Spring Church, this

* A loop trail for hikers and equestrians from Maple Springs to Collie Ridge was brushed out in 1971 following, for the most part, old wagon road traces. About 500 horsemen had used it in 1971. Horses were trucked in, some from as far away as Tennessee.

The hiking trail from Temple Hill to First Creek Lake was rerouted somewhat in 1972 and used occasionally for conducted nature walks.

** A primitive campsite was established at First Creek Lake in 1972. It has had some use since by hikers.

road is to remain as a minor gravel road and the campsite intended only for hikers.

D. LAND AND CAVE PASSAGE CLASSIFICATION

In the foregoing discussion we have dealt individually with proposed actions directly affecting each of the three zones of the park recognized by the Congress as being of national significance. When the park was established, Congress charged the National Park Service with administering it in accordance with the act of August 25, 1916 (39 Stat. 535), from which the following is excerpted:

"The National Park Service thus established shall promote and regulate the use of the Federal areas . . . by such means and measures as conform to the fundamental purpose of the said parks, . . . which purpose is to conserve the scenery and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." (U.S.C., Title 16, Sec. 1)

In 1941, the National Park Service inherited at Mammoth Cave a pattern of public use that had begun early in the 19th century. By the mid-20th century, much of this use had become antiquated and the National Park Service and concessioners responded by improving roads, trails, accommodations, and services under the MISSION 66 program for the benefit of cave visitors. Before that decade (1956-66) had ended, phenomenal increases in travel and new discoveries underground prompted the National Park Service to re-examine its management of the park. It inaugurated master plan studies that revealed that some drastic changes in public use and management were required if the Service was to meet its obligations to the public under the Congressional mandate cited above.

One of the first steps in planning is to analyze the park's resources and to classify them. Such classification may be represented graphically to show readily the degree of preservation and the allowable intensity of use that these park resources will accept without jeopardizing their perpetuation for future generations.

1. Land Classification

a. **Present Condition** — The National Park Service now uses a modification of the land classification system developed by the Outdoor Recreation Resources Review Commission described in its report to the President and to the Congress titled *Outdoor Recreation for America*, January 1962, pp. 96-120 inclusive. Its application to park planning is contained on pp. 32-35 of a booklet titled *Compilation of the Administrative Policies for the National Parks and National Monuments of Scientific Significance (Natural Area Category)*, Revised 1970.

Public lands, including park lands, are classified under six categories:

Class	Definition
I	High density recreation area
II	General outdoor recreation area
III	Natural environment area
IV	Outstanding natural area
V	Primitive area
VI	Historic and cultural area

Classes I and II identify the lands reserved for visitor accommodations, for administrative facilities, formal campgrounds, two-way roads, etc. of varying intensities, *both existing and proposed*.

Class III lands represent significant natural values which distinguish areas of the National Park System from other public lands providing outdoor recreation. Only those minimum facilities required for public enjoyment, safety, health, and preservation and protection of the features are provided, such as one-way motor nature trails, small visitor overlooks, informal picnic sites, short nature walks, and wilderness-type uses. Such limited facilities must be in complete harmony with the natural environment.

Class IV lands are those with unique natural features. These lands usually represent the most fragile and most precious values of a natural area. Class IV identifies the terrain and objects of scenic splendor, natural wonder, or scientific importance that are the heart of the park. These are the lands which must have the highest order of protection so that they will remain "unimpaired for the enjoyment of future generations." Nothing in the way of human use should be permitted that intrudes upon or may in any way damage or alter the scene. The sites and features are irreplaceable.

Class V are the primitive lands that have remained pristine and undisturbed as a part of our natural inheritance. They include in some instances lands that, through National Park Service management, have been restored by the healing processes of nature to a primeval state. There are no water impoundments or other intrusions of man to mar their character and detract from the solitude and quiet of the natural scene.

Class VI are the lands, including historic structures, of historical or cultural significance.

BROWNSVILLE

MAMMOTH CAVE

LAND CLASSIFICATION PLAN

CLASS 1
CLASS 2
CLASS 3
CLASS 3A
CLASS 4
CLASS 4A

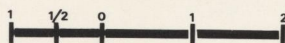


--- PARK BOUNDARY

- - - - - PROPOSED ROAD



NORTH



SCALE IN MILES

MILL HOLE

PARK CITY

135-20002

b. **Ultimate Action** — The accompanying land classification plan drawing (see p. 33) represents graphically the categories of use and preservation accorded the surface lands and waters of Mammoth Cave National Park as called for in the master plan. The peripheral staging area is shown in the Class I category; Class II includes all two-way public use roads and minor developed areas such as cave entrances; Class III covers surface streams, and lands containing motor tour routes, trails, campsites, and the like; and Class IV delineates lands of special scientific value, including Big Woods, "basin ecosystems," Bylew Creek Valley, a tract of virgin forest in the vicinity of Historic Entrance, Goblin Knob, Turnhole Bend, Woolsey Valley, Strawberry Valley, Double Cellars and Hunt Sinks, Deer Park Hollow, and portions of the ridge tops on Mammoth Cave Plateau. These Class IV areas are to remain free of any new development; some will be surrounded with Class III zones where only harmonizing development may occur.

All of Flint Ridge is designated Class IV except for the roads serving cave entrances and the powerlines, which provide electricity for illuminating Mammoth Cave and for pumping water. Because these must remain, at least for the time being, they are placed in Class III corridors 50 feet wide. Nevertheless, by Class IV designation, the National Park Service recognizes the great worth of the underlying cave system for research, and obligates itself to seeking the cooperation of the Department of Labor in discontinuing the Great Onyx Civilian Conservation Center and its removal from Flint Ridge at an early date (see I.A.1.4.b.). This action and obtaining water from another source will do much towards restoring the surface of Flint Ridge to a more natural condition.

No lands in the park were designated Class V, primitive, because evidences of past uses by man and his abandoned works, such as farmsteads, sunken wagon roads, fence lines, chimneys, building foundations, gullies, and the like, are still evident to knowledgeable observers on the ground and apparent from the air. As time passes, these things will disappear, but this will probably require several more decades. Meanwhile, the National Park Service has identified certain lands and waters and shown them as Class IIIA and Class IVA on the land classification plan drawing. By this action, the National Park Service declares that it will so manage these lands that they may become of Class V caliber in the future.

The bulk of Class IIIA lands are north of the Green River and they will continue to be managed very much as they have been for the past 30 years, though primitive trails will be marked for those seeking a backcountry experience on foot, and some abandoned roads will be available for use by horseback riders.

Woolsey Valley is a typical Class IVA area with its high scenic and scientific values. It is an outstanding example of solution valley physiography. Long Cave is at the east end of Woolsey Valley and contains the largest and most important bat hibernaculum in the park. It shelters a colony of Indiana bats (*Myotis sodalis*) that are listed as an endangered species by the Secretary of the Interior. No development of Class IVA land is contemplated.

The master plan identified no lands, structures, or objects in the Class VI category – historic and cultural. This matter has been re-evaluated. In compliance with Section 2(b) of Executive Order 11593, dated May 13, 1971, nomination forms have been completed for inclusion of the following on the National Register of Historic Places: Mammoth Cave Railroad train consisting of the dummy-type locomotive "Hercules" and one coach designed as a combination baggage-passenger car, saltpeter vats and the two tubercular huts within Mammoth Cave, and Salts Cave. In addition, other historic, cultural, and archeological sites and objects, potentially eligible for nomination to the National Register, are being studied. Upon professional evaluation, those that meet the criteria will be nominated.

Those appearing in the National Register, and those eligible for nomination, will be identified on the land classification plan as Class VI areas. Similarly, those in cave passages will be designated in Zone F on the cave zoning plan (see discussion under I.D.2.). The acreage covered by each of the historic and archeologic sites and objects is too small to be shown on the drawing on page 33 of this report. Nevertheless, these sites and objects will be managed by the park staff as Class VI. With respect to archeological sites, the Service deems it unwise to publicize their location lest irreplaceable evidence is disturbed or objects removed by unauthorized persons. Few pre-Columbian sites are known in the Green River Valley outside the park.

Through such measures as maintenance, preservative exterior treatment, adaptive use, and restoration, National Register properties will be perpetuated. Any proposed action affecting a resource that has qualified or potentially qualifies for the National Register will be referred to the Advisory Council on Historic Preservation for advice before final action is taken. This is in accordance with procedures established in Section 106 of the National Historic Preservation Act of 1966 (80 Stat. 915).

c. Interim Action – As actions affecting land and water use are carried out, upon adoption of the master plan, present uses will change to the categories called for on the land classification plan drawing.

2. Cave Passage Classification

a. **Present Condition** — Prior to 1970, neither the National Park Service nor anyone else had ever attempted to devise a system of cave passage classification for designating an acceptable level of use based on the ability of the resource to absorb it. This would be a desirable guide for park management. The master plan contains an innovative system of zones labeled "A" through "E" in descending order of intensity of use and development, and Zone F, which recognizes outstanding natural and historical features and passages.

The following tabulation and paragraphs of explanation are extracted from the preliminary draft master plan dated December 1970:

CAVE ZONING SYSTEM

ZONE	DEFINITION	EXAMPLES
A	Intensive use area	Snowball Dining Room; rest areas
B	Fully developed passage; electrically lighted	Cleaveland Avenue, Broadway, etc.
C	Partially developed passage; no electric lighting	Nickerson Avenue, Fox Avenue, old commercial routes in Colossal, Crystal, Great Onyx and Proctor Caves, back part of Salts Cave
D	Natural passage	Blue Spring Branch, Marion Avenue, Columbian Avenue, Pohl Avenue, front part of Salts Cave
E	Scientific study or pristine passage	Paradise passage in New Discovery, parts (or perhaps all) of Upper Turner Avenue, White Cave, Long Cave in winter
F	Outstanding natural or historical feature or passage	Saltpeter vats and pipes, unique column in Upper Turner Avenue, Attic Room

b. **Ultimate Action** — As with the land classification plan, the cave zoning system will guide management in its development of the cave passages and identify the uses that are compatible with the resource.

This will range from intensive use such as in the Rotunda of Mammoth Cave to rare visits to passages where formations or archeological remains are so delicate that they may be destroyed inadvertently. Most places of greatest scientific value may be reached only by those possessing uncommon physical stamina and courage, and who are familiar with caving techniques.

c. Interim Action – The master plan recommends the following criteria to guide preparation of the resource management plan following adoption of the master plan:

No passages in Flint Ridge or Joppa Ridge are to be zoned "A" or "B" and spelunker traffic is to be limited to zones "C" and "D." All passages not now discovered are zoned "E" automatically.

Cave Zone A is limited to those areas where people assemble, such as Snowball Dining Room, Grand Central Station, Mt. McKinley comfort station, and elevator portals. Such places, essential to the comfort and convenience of the visitor, are located in sections of cave passages that have low esthetic and/or scientific value.

Cave Zone B includes those cave passages provided with electric lighting esthetically arranged and developed with trails, bridges, steps, stairways, handrails, etc. Guides accompany all parties and a fee is charged. Parties not exceeding 120 persons with two guides may be conducted over the trails in passages so developed. Depending on the width of the passages and fragility of formations, up to 650 persons per hour may be admitted to Zone B on semi-guided tours. Party size mentioned above is maximum; visitors will generally have a higher quality experience when numbers are smaller.

Those passages which are partially developed or were once developed and are now abandoned are in Zone C. Trails range from good to somewhat primitive; other development is limited to the essentials for visitor safety. There is no electric lighting. Such passages provide a "wild" cave experience for visitors without training in caving techniques. Lighting is by hand-carried lanterns. Tour size, with at least one guide, is limited to from 25 to 40 persons, depending on the passages traversed, and there is a fee for the services of the guide.

Natural passages are classified in Zone D. Only those who are properly equipped and experienced in caving techniques may traverse these passages, which have not been improved in any way except for possibly remedying dangerous situations. Parties must be small and a special fee is charged for guided tours.

Zone E includes those portions of the cave systems reserved for scientific study and approved for exploration, or pristine passages which would be irreparably damaged by heavy use. Temporary "E" zoning may also be obtained for non "E" passages by scientists conducting approved projects.

Cave passages containing unique natural and historic features are in Zone F. They may be located within Zones B through E. Both the saltpeter vats and tubercular huts are in Zone B passages. Special measures may be taken to ensure their protection and preservation, as warranted. This may include highly restricted visitation to places such as a bat colony during certain seasons of the year.

Nothing in this zoning system reduces the authority of the superintendent to further regulate entry into and use of the cave passages; it is a guide which identifies the maximum degree of use permissible for the preservation of the underground features. If approved, this cave zoning system will be published in the *Federal Register* and park regulations will be based upon it.

It is impractical to compress into the pages of this report drawings to represent the lengthy honeycomb pattern of passages in the cave systems, hence there are none to illustrate this cave zoning system. Such a drawing will be prepared, at a later date, as part of a resource management plan. Knowledgeable people outside the National Park Service will be consulted and asked to assist in drafting it.

3. Wilderness Study

The *National Wilderness Preservation Act* (PL 88-577) requires the National Park Service to study the lands within Mammoth Cave National Park and to report to the President and to the Congress, by September 3, 1974, as to their suitability or non-suitability for wilderness designation. The following was considered by the Service in finding park lands non-suitable at this time.

a. **Background Data** — The land was exploited beginning with its settlement during the last decade of the 18th century. Mammoth Cave, itself, was mined for saltpeter used in the War of 1812; public tours began in 1816.

Park lands are rugged; soils are acid and have been moderately to severely eroded. Soil fertility, where farmed, was further depleted by raising corn and tobacco. Similarly, ruthless cutting of trees on the steeper land and forest fires lowered soil fertility and the species composition changed. American chestnut has been lost to blight; wood

bison and passenger pigeon are extinct, and black bear has been extirpated.

In 1936, 5 years before the park was established, 56 percent of the 47,348 acres studied by Service foresters, supported a recognizable forest cover type. The balance of the land was open. Of the remaining 44 percent, 14 percent was former fields which were beginning to regenerate to forest, while 30 percent was not because it was still being tilled or had been abandoned too recently for tree growth to reappear.

Within the area designated for the park, about 600 families lived. There were 4 churches, 11 one-room school houses, over 250 miles of wagon and motor roads, 9 ferries and one ford to cross rivers, several country stores, a post office, and 4 hotels for cave patrons. Families abandoned their farmsteads after the land was purchased.

The Civilian Conservation Corps (CCC), during the late 1930's and early 1940's carried on a number of land improvement projects through their work programs. Corpsmen razed structures, removed fences, checked erosion, and reforested fields to assist natural processes in reclaiming the land. However, a 1966 map of the park's vegetative cover reveals that broomsedge was still dominant in old fields, and pine plantations had not yet been invaded by the climax hardwoods. The slow rate of recovery indicates that the soil is still infertile following nearly 150 years of exploitation.

b. Field Study — Under the Wilderness Act, a procedure for study has been established which starts with identification of roadless areas 5,000 acres in extent, or larger. Like the farmsteads, most roads were abandoned when the people moved out. Hence it was possible to delineate 4 areas labelled "A" through "D" on the drawing on p. 41. These roadless areas total 39,185 acres or 76 percent of park lands.

Each of these roadless areas was studied by the Service and its report was released in April 1972. The finding was that none of the land in the park met the criteria for wilderness designation in the act. This decision was reached on the basis of the history of land use described above, consultation with others, and an analysis of resources and uses of the 4 roadless areas. A summary of the consultations and analysis follows:

(1) **Symposium** — This was conducted by the Service at Mammoth Cave National Park, May 22 to 26, 1967, inclusive. Its purpose was to consider the "application of the Wilderness Act as the means for preserving the surface and underground features of the park."

Symposiasts included representatives of the National Park Service, Geological Survey, both of the park's concessioners, the Office of the Secretary of the Interior, Cave Research Foundation (CRF), and the National Speleological Society (NSS). Before the meeting, each representative was supplied with a copy of the Wilderness Act, a briefing statement prepared by the Service, and a copy of *A Wilderness Proposal for Mammoth Cave National Park, Kentucky* published by NSS a few weeks earlier (see Section VIII, Alternatives, in this statement). During the symposium there were discussions and a series of field trips, both on the surface and underground. The discussions were supplemented by written statements of observations and conclusions prepared by several of the participants.

In general, both the NSS and CRF advocated "underground wilderness" designation of the Flint Ridge Cave System, then the longest explored cave in the world. CRF saw such designation as a means of preserving the caves for their scientific values, and NSS saw it also as a means of opening the caves to the sport of "recreational caving." To the NSS this is a valid "wilderness use."

Both groups recognized that there was inseparable affinity between the surface and underground — hydrologically, meteorologically, mineralogically, geologically, and biologically — and that the surface of Flint Ridge does not now qualify for wilderness. This is because of the roads, powerlines, Great Onyx Civilian Conservation Center, a church, CRF field office and bunkhouse, fire lookout tower, water collection and storage system for the park, and immediate past land uses: Great Onyx Cave and Crystal Cave properties were shown commercially and the properties were not added to the park until April 7, 1961. Some of these disqualifying surface uses will continue long into the future.

As for other surface areas of the park, which are roadless, many symposiasts had the philosophical attitude that these may be included in the National Wilderness Preservation System "if we so desire." Moreover, whatever area is designated will be but a "small portion of an already highly developed geographic region."

(2) Master plan public meeting — An informal meeting was held by the master plan team at the park on May 25, 1968 to learn what others thought the plan for the park should be.

Several months preceeding this meeting, the National Parks Association (NPA) had prepared and distributed their proposal entitled *A Wilderness Plan for Mammoth Cave National Park and the Surrounding*

Region (see Section VIII). NPA's proposal included designation of practically all of the park in wilderness (the major exception was Mammoth Cave Ridge); recommended no expansion of lodgings; picnicking and camping were to be phased out; and major roads were indicated on the drawing to be closed including the two ferries across Green River.

The master plan team's public meeting was attended by about 100 people of whom about 50 spoke for themselves, or represented public bodies and organized groups.

Spokesmen for conservation organizations strongly endorsed the wilderness proposals, surface and underground, of NSS and NPA. On the other hand, most local people said they were opposed to any wilderness in the park because the National Park Service now had all the authority it needed to preserve and conserve it, wilderness would deter development of southcentral Kentucky, and all facilities in the park should be fully developed as a means of enhancing it for public use. Moreover, some asserted that the park had "ruined" Edmonson County and its citizens had been denied use of some roads in the park.

(3) Comparative study of roadless areas — The following tabulation by the Service was derived from an analysis of old maps:

Man's Works Affecting the Land

Roadless Area Studied	Gross Acreage	Acres Not Forested	Percent of Gross Acreage	Number of Tracts Purchased	Number of Farmsteads (1)	Miles of Road	Number of Cemeteries (2)
A	5,637	1,563	28	43	42	15	7
B	16,621	3,662	22	226	182	89	17
C	11,899	3,272	28	138	131	50	15
D	5,028	1,810	36	70	55	15	8
Totals	39,185	10,307	26	477	410	169	47
	(3)						

(1) A farmstead usually consisted of a one-story log or a 2-story frame house with stone or brick chimney, smokehouse, woodpile, garden, and orchard. Corn and tobacco were the principal cash crops. Soil erosion was rampant. Most tracts were fenced with barbed or woven wire.

(2) Most cemeteries are family plots containing a dozen or fewer burials, often identified by unmarked stones.

(3) Total park acreage is 51,354.

From the tabulation above, it appears that each of the four roadless areas is affected about equally by man's works. However, each of the areas has been untrammelled by man for the past 30 to 45 years, except for 672.78 acres on Flint Ridge purchased only 12 years ago. During the CCC period, structures were razed, fences removed, erosion checked, and trees were planted. Despite this, old fields covered with broomsedge and briar patches, fence rows, exotic plants at homesites, occasional chimneys and building foundations, burial plots, sunken wagon roads, and erosion gullies are clearly visible. Knowledgeable observers will see more subtle things like plant indicators of early stages of forest succession, reforestation projects, check dams, and pits where walnut stumps were removed to salvage the valuable wood. Several decades will pass before the plant cover again resembles the original hardwood forest.

Two major streams cross the park: 26 miles of Green River and 6 miles of Nolin River. Both are impounded by Dam and Lock 6 completed on the Green in 1907 by the Corps of Engineers. The lock was deactivated in 1951. Both streams are further regulated by flood control dams upstream. Sightseers and fishermen use motorboats on the slackwaters and the *Miss Green River*, a sightseeing boat carrying 125 passengers, is powered by an inboard diesel engine. She is operated by a park concessioner on a 3.25-mile segment of the Green. These rivers cross roadless area "A", "B", and "C" (see map, p. 41). The impoundments are permanent works of man and motorboat use on the slackwaters will continue as provided in the master plan. Neither impoundments, river flow regulation, nor motorboating are compatible with wilderness. Yet some of the finest riverscapes in Kentucky are found in the park.

The following is a summary of some of the natural characteristics and uses of each roadless area:

Roadless Area A: approximately 5,637 acres measuring about 4 miles long by 3 miles wide. Excellent overviews of this area can be obtained from Whistle Mountain and Indian Hill, respectively. Some fine cliffs may be viewed when traveling on the rivers. First Creek Lake is located on the floodplain of Nolin River, the only one so situated in the park. There are several outstanding examples of plant associations, an acre or two in size, at the mouth of Bylew Creek, in Flea Cave and Cubby Cove Hollows, and on the north flank of Indian Hill. Hemlock trees grow at some of these localities disjunct from their nearest counterparts 100 miles east in the Cumberland Mountains. Motorboats carrying fishermen and sightseers put in at Houchins Ferry and ply the rivers. Hikers and

horseback riders will use the proposed trails and a primitive campsite is planned for First Creek Lake.

Roadless Area B: approximately 16,621 acres and of irregular shape about 5.5 miles across in each direction. There are no prominent viewpoints in this area except of Turnhole Bend from Ky 70, and of the general area from Brooks Knob firetower. Turnhole Bend is the area's outstanding scenic surface feature, a classic example of an incised meander. Turnhole Spring is the largest resurgence on the Green River. Here steamboats turned around in bygone days. Lee Cave, a major passage, was rediscovered by a CRF team a couple of years ago, beneath Joppa Ridge, and there are a few shallow caves in limestone north of the Green. Wet Prong of Buffalo Creek has some attractive segments and numerous springs along its course. It and Dry Prong are sinking streams at certain times of the year when their waters go underground. *Miss Green River* passengers frequently observe deer, raccoons, turtles, kingfishers, and ducks on their trip. Private motorboats are launched at both Houchins and Mammoth Cave ferries, primitive campsites are to be located at Maple Springs and on river islands, and new trails for hiking and horseback riding are proposed. A primitive campsite and environmental education center are to be established at Maple Springs between Roadless Areas "A" and "B."

Roadless Area C: about 11,899 acres in extent and measuring about 3 by 5 miles. In the northeasterly part is Big Woods, a 300-acre tract of hardwood forest which has probably not been cut, and the adjoining Wilson Cave Hollow. In addition to shallow, Wilson Cave, the hollow contains a small waterfall, some pretty scenery, and an attractive beech-maple forest. A 9-mile segment of the Green River is free-flowing and is to be treated generally as a "wild" river with no motorboat use. Nappers Rollover and Goblin Knob are interesting geologic features. Overviews may be obtained only from the Flint Ridge and Hickory Cabin fire lookout towers. The northern half of the Flint Ridge Cave System underlies that portion of this area south of the Green.

Roadless Area D: about 5,028 acres in size and roughly 5 miles long by 2 miles wide. This area contains one of the finest examples of a solution valley in the park. At the west end of the area is Cedar Sink through which passes an underground stream. Some cave passages in the phreatic zone have been entered from Cedar Sink. At the east end is Long Cave, the most important

hibernaculum in the park for it shelters a colony of the Indiana bat, an endangered species. Vegetatively this roadless area is interesting, also. There is a strong visual contrast between the cedar karren and the hardwood stands as viewed from the valley rim at the old quarry along Ky 70. There are probably some small areas of savanna vegetation which is a relict of that which formerly grew on The Barrens. No developments have been planned for this area in the future.

c. Conclusions — Application of the definition of wilderness in the act to the roadless areas at Mammoth Cave leads to the following conclusions: they are no longer "trammeled by man," and "man himself is a visitor who does not remain." The areas generally offer "outstanding opportunities for solitude" and "a primitive and unconfined type of recreation." Each area appears to be large enough to "make practicable its preservation and use in an unimpaired condition," and they "also contain ecological, geological, and other features of scientific, educational, scenic, or historical value."

However, the Wilderness Act also specifies that the land shall "generally appear to have been affected primarily by the forces of nature, with the imprint of man's works substantially unnoticeable." This condition is not met at Mammoth Cave. The Service maintains that many more decades will elapse before the plant cover will again resemble the original hardwood forest. Furthermore, the impoundments of the rivers and regulation of their flow are "permanent improvements" not compatible with wilderness.

Motorboat use will continue on the rivers, trails will be built through the woods and abandoned fields of the Hilly Country, and campsites established. As explained previously, the magnitude of these uses is expected to be an anathema to wilderness.

For these reasons, the Service finds no lands suitable at this time for wilderness designation in Mammoth Cave National Park.

In time, most of man's past works will disappear, but when this condition will prevail is unknown at this time. When park lands meet wilderness criteria, at a later date, the President may so recommend to Congress. See I.D.1.b., p. 35.

Much of the discussion about "underground wilderness*" has focused on the Flint Ridge Cave System which has been studied and mapped by scientists since 1947. The proponents of underground wilderness feel that the language of the Wilderness Act is broad enough to cover this concept except for the "semantic problem of subsurface acreage." Surely, caves are places where "man himself is a visitor who does not remain," and they provide truly "outstanding opportunities for solitude." On the other hand, the words, "landscape," "area," and "land" all appear in the definition of wilderness in the act and each refers specifically to the surface of the earth, according to the dictionary. Clearly, when considering passage of the Wilderness Act, Congress did not extend the concept of wilderness to caves or cave systems. In view of the fact that underground wilderness was not identified in the Wilderness Act, nor have underground wildernesses been established subsequently, the National Park Service neither endorses nor proposes underground wilderness for Mammoth Cave National Park.

E. INTERRELATIONSHIP WITH OTHER PROJECTS

In its role as the foremost tourist attraction in Kentucky, there are strong economic ties between the park and Cave Country. Furthermore, because of the karst topography common to the region, hydrology is equally important. In fact, economics and hydrology are interrelated as described hereafter.

The Service has determined that it is more economical for it to buy water from an adjoining water district than to operate its own treatment plant. When a water main is laid alongside one of the park's approach roads, various tourist accommodations and services will spring up along it. Some of these will replace those in the park that are to be phased out; others will be in response to increasing travel. These developments must have a uniformly high standard of appearance and service, else travel to the region will suffer.

If the water main parallels Mammoth Cave Parkway and the limited access policy of the Kentucky Department of Highways prevails, the scenic character of this approach to the park will be retained. On the other hand, if the water line parallels Ky 70, "strip" commercial development will spring up along it causing traffic congestion, unless the road is widened, and altering the rural character of the area which makes a pleasant approach to the park.

* The genesis of the idea that caverns are wilderness may have first appeared in print on pp. 16-18 under the heading of "Interpretive Education" in a booklet titled *Speleological Research in the Mammoth Cave Region, Kentucky: Elements of an Integrated Program* published by the Cave Research Foundation, June 1960.

Moreover, as commercial enterprises come closer to the park, the danger becomes greater of polluting the underground streams which are in the caves beneath Mammoth Cave Plateau. Sources of pollution include sewage disposal systems, spillage of petroleum products, agricultural pesticides and fertilizers, disposal of waste in sinkholes, and the like. Pollutants could kill the aquatic life in the underground streams and could make conditions unhealthful in the cave passages to the point where public tours would have to be cancelled. Either would be a tragedy. In fact, it would be desirable to establish a sewer district at the same time water became available.

No water quality standards have been established for underground streams. Furthermore, the whole matter of waste disposal in the watersheds of these streams, including both the Sinkhole Plain and Mammoth Cave Plateau, has to be monitored and controlled, if necessary, to preserve the cave environment.

Kentucky has no land use laws though such are currently (1974) under consideration by the legislature. The Barren River Area Development District (BRADD), one of 15 multi-county districts in the Commonwealth, is charged with formulating and coordinating regional plans. Its plans are advisory and, if adopted, are carried out by the agency having jurisdiction. The Superintendent of Mammoth Cave National Park has been working closely with Commonwealth and BRADD officials, with the county judges of adjoining counties, and with the city councils of nearby towns concerning the foregoing and other matters of mutual interest and concern.

Now that Green River Parkway, between Owensboro and Bowling Green, is open to traffic, travel to the park through Brownsville should increase. This parkway eases travel from the vicinity of Chicago and St. Louis. Brownsville and Edmonson County generally should benefit economically.

On a 150-acre tract bordering park land $\frac{1}{2}$ mile east of Chaumont along Ky 70, an amusement (theme) park opened in July 1973. A franchised unit of a national campground chain, coupled with a small theme park, plans to open in 1974 along Ky 70 $\frac{1}{2}$ mile west of Cave City. Thus two more tourist-oriented businesses have been added near the park to about a dozen others established since the park's master plan study was completed in December 1970.

Further insight into the region's economy is contained in the forepart of Section II, Description of the Environment.

II. DESCRIPTION OF THE ENVIRONMENT

The Region

Mammoth Cave National Park is located in Barren, Edmonson, and Hart Counties, south-central Kentucky, part of a vacation region known as "Cave Country." The master plan for the park was developed in the context of the region's natural and recreational resources and with respect for the social and economic effects of the proposals.

During the past 20 to 25 years, Cave Country has been turning from agriculture to manufacturing and tourism as its major sources of income, but this transition has not provided jobs for everyone. There has been an out-migration, especially from the rural areas, to urban centers in Kentucky, Indiana, Ohio, and Michigan. The rural population of Cave Country has been declining. For many, ties to the homeland are strong and they return to visit relatives and friends. Frequently, they visit Mammoth Cave to share with their children an experience of their youth.

Surrounding Mammoth Cave National Park is a rural area of small farms, few of which are self-sustaining. Strip mining for coal started recently near the park's northwestern border. About a mile north of the park is Nolin Dam constructed by the Corps of Engineers for flood control. Along the shores of Nolin River Lake are marinas, picnic areas, campgrounds, and summer homesites, and there is recreational boating and fishing on the lake. South of the park, about 25 miles distant, is Barren River Lake, another Corps' project, and a State resort park has been developed on its shores. Within 10 miles of the southeast corner of the national park, are a half dozen privately owned caves which have been developed and are being shown to the public.

Clustered around Cave City and several other small towns nearby, are a frontier village, outdoor theater, chair lifts, wax museum, wildlife museum, curio shops, service stations, motels, and restaurants. A huge theme park of the Disneyland-type is being planned near Cave City.* In 1969, within an hour's travel time of Mammoth Cave, there were 58 motels providing 2,300 units and 25 campgrounds providing 7,633 campsites. More units have been added to keep up with the demand, among which are two campgrounds within 2.5 miles of the park's main entrance at Chaumont which have a total of 250 sites.

Two large population centers and many smaller cities and towns in a predominantly rural setting are within two hour's travel time. Louisville, Kentucky (361,500 people in 1970), and Nashville, Tennessee (448,000 people in 1970), are connected by a new interstate highway (I-65). This road, and others feeding it, make it relatively easy for

* A theme park opened on July 4, 1973, a half mile east of the main entrance to Mammoth Cave National Park along Ky 70-255. It is located on 150 acres of land adjoining the national park.

Kentuckians as well as residents of adjoining states to reach Mammoth Cave. This transportation corridor passes within 2.3 miles of the main park entrance at Chaumont. The Dixie Highway (US 31W) dating from the early 19th century and the mainline of the Louisville and Nashville (L&N) Railroad built before the Civil War occupy this corridor also. A Kentucky Department of Highways Survey made August 23, 1970, gives the following breakdown of visitors to Mammoth Cave:

Kentucky	36.4%	Michigan	7.0%
Indiana	13.2%	Tennessee	4.4%
Ohio	11.8%	Missouri	0.7%
Illinois	7.4%	West Virginia	0.2%
All Others		18.9%	

Note: The accompanying illustration was based upon 1968 National Park Service data (see p. 51).

New highways, under construction, will bring more people into Cave Country, viz. Green River Parkway from Owensboro in northwestern Kentucky and Cumberland Parkway from Somerset in eastern Kentucky. These are projected to carry a total of 16,300 cars per day by 1990.

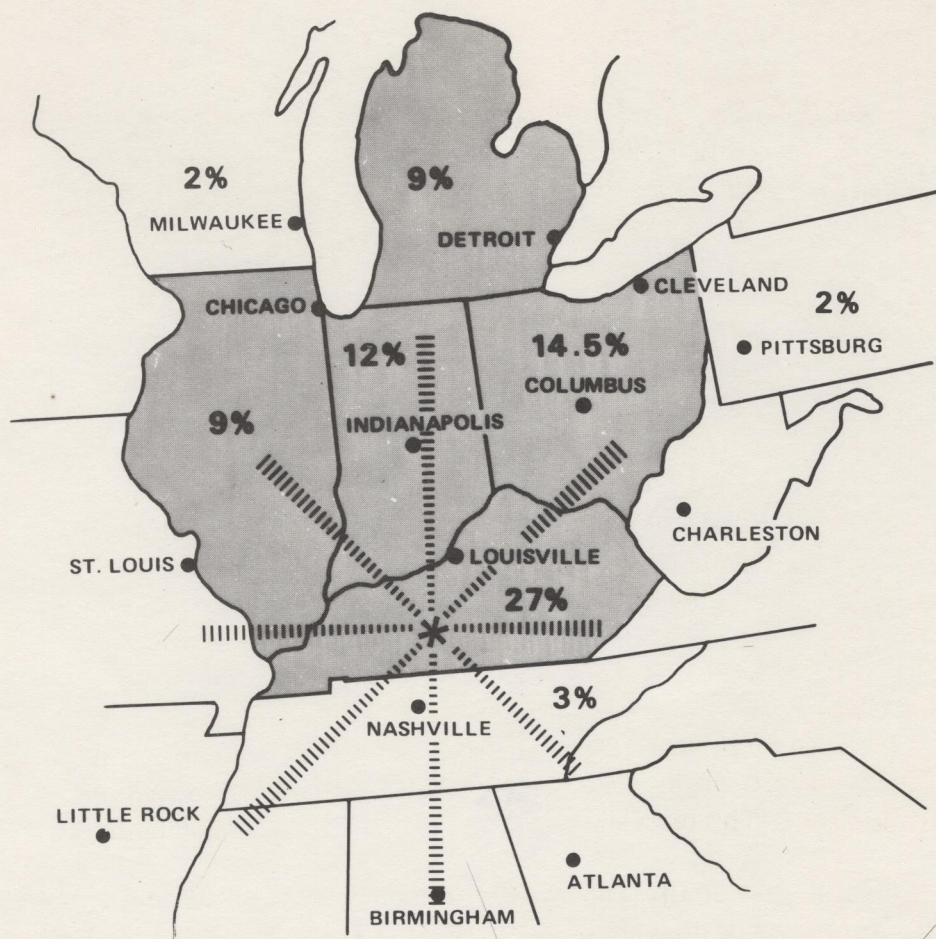
Average daily traffic in 1970, at Cave City interchange on I-65, 9 miles east of the park via Ky 70, was 11,363 cars; by 1990, 22,300 cars are expected. Mammoth Cave is within a day's drive of 80 million people. It is the foremost tourist attraction in Kentucky according to the Department of Public Information at Frankfort.

Copeland's *1971 Survey of Travel in Kentucky* reports that, since 1954, all retail business rose at an average annual rate of 5.2 percent, but travel spending increased 6.3 percent. Tourists from other states spent 426 million dollars in Kentucky and 159 million dollars was spent by Kentuckians traveling within their own State or a total of 585 million dollars. This represents 10 percent of Kentucky's retail business.

The cities of Glasgow and Bowling Green, about 15 and 25 miles distant, respectively, are growing as new industries are established in their area.


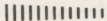
Thus far, lack of municipal water and sewer has restricted development in the immediate environs of the park. Recently, however, three water districts have been formed; Green River, Barren River, and Edmonson County, each with adequate supplies and each expanding its services to new customers. No sewage disposal districts have been established as yet.

Water will spur development and that will require waste disposal. The southeast part of the park and the area to the south of it is underlain with cavernous limestones, and water which goes underground finds its way into natural conduits which drain into the

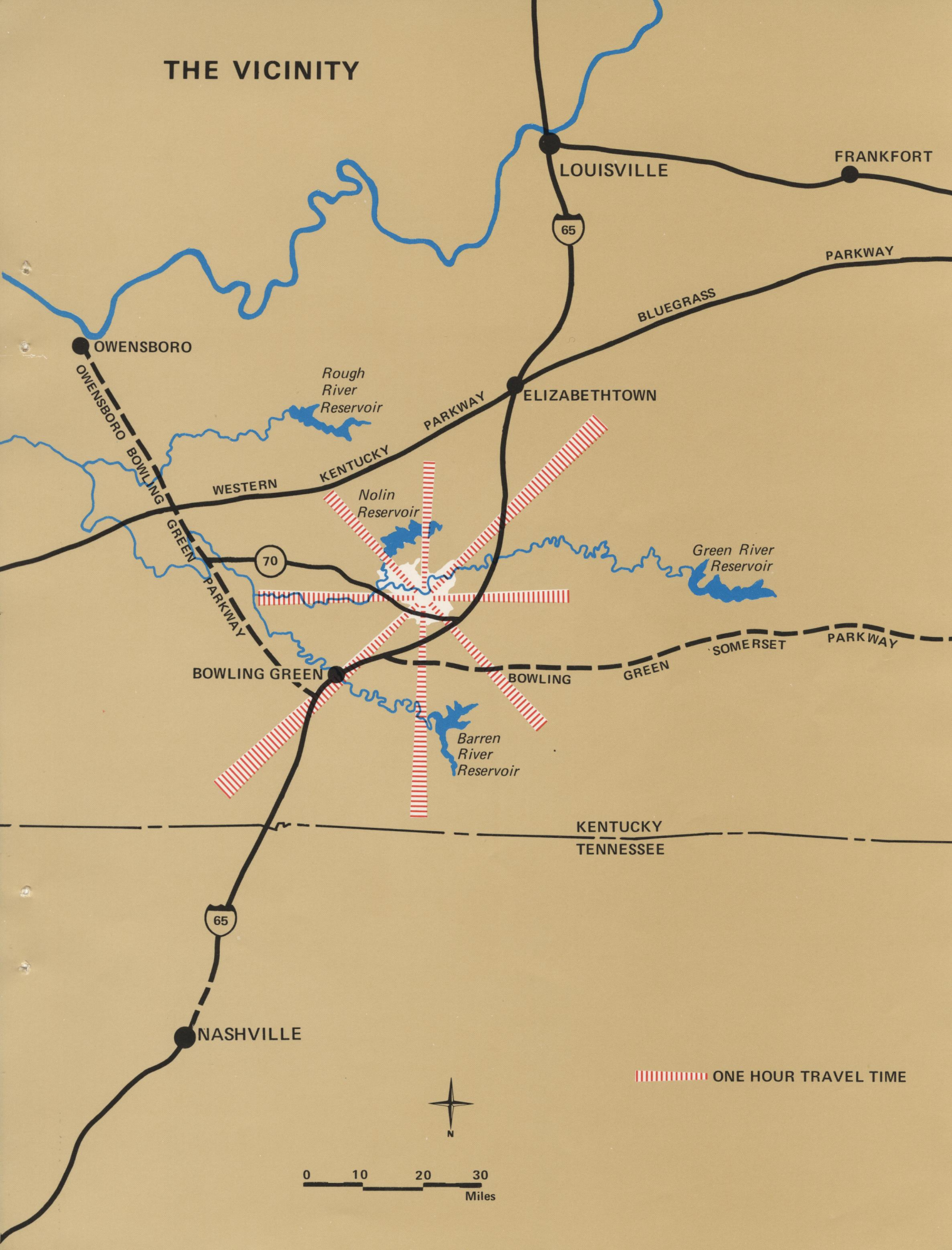


Cities and Population (1970)

Akron, Ohio	275,425	Indianapolis, Ind.	744,624
Atlanta, Ga.	496,973	Knoxville, Tenn.	174,587
Birmingham, Ala.	300,910	Lexington, Ky.	108,137
Charlotte, N.C.	241,178	Little Rock, Ark.	132,483
Charleston, W. Va.	71,505	Louisville, Ky.	361,472
Chattanooga, Tenn.	119,082	Madison, Wis.	173,258
Chicago, Ill.	3,366,957	Memphis, Tenn.	623,530
Cincinnati, Ohio	452,524	Milwaukee, Wis.	717,099
Cleveland, Ohio	750,903	Nashville, Tenn.	448,003
Columbus, Ohio	539,677	Peoria, Ill.	126,963
Dayton, Ohio	243,601	Pittsburg, Pa.	520,117
Detroit, Mich.	1,511,482	St. Louis, Mo.	622,236
Grand Rapids, Mich.	197,649	Toledo, Ohio	383,818

 TRAVEL INFLUENCE AREA
 DISTANCE FOR 8-HOUR TRAVEL
 % VISITATION FROM STATE

THE VICINITY



VISITOR SERVICE AREA

- * COMMERCIAL CAVE
- OVERNIGHT ACCOMMODATIONS
- CAMPGROUND
- * GOLF COURSE
- MARINA

||||| ONE HOUR TRAVEL TIME



> water which goes underground finds its way into natural conduits which drain into the Green River. Some of these pass through the park's cave systems. Polluted water could harm or kill the cave animals and waste discharges like untreated or inadequately-treated sewage, petroleum products, or certain industrial wastes could force the closing of park caves if it is carried into them by the underground streams. It is hoped that, through local zoning and/or careful scrutiny of waste disposal by State and local officials, that damage to the caves will not occur.

It is hoped, also, that unattractive developments will not be permitted on roadways approaching the park. The traditional land uses of agriculture and forestry are pleasing to the eye and add to the anticipation of a national park visit. Motoring through open land, in itself, is a primary recreation activity enjoyed by great numbers of the populace.

Planning for Cave Country is centered in the Barren River Area Development District (BRADD) and the Superintendent of Mammoth Cave National Park is a member of its council. A report titled *The Year 2000: A Long Range Plan*, printed in 1970, gives an overview of planning problems in the region. Several of the recommendations fortify the park's master plan, e.g.,

- consolidation of farms and forest lands into larger units for more economical operation
- establishment of vacation farms, hunting preserves, and fishing ponds
- construction of six scenic highways for passenger cars, including one across the park to connect Nolin River Lake and Barren River Lake, thereby combining the three areas into a more cohesive recreation unit

For the park itself, the BRADD report suggests:

- that its scientific and natural integrity be maintained
- that day-use predominate
- that primitive walk-in and boat-in campsites be provided
- that a greater variety of cave trips be offered with smaller parties to increase quality,
- that the park area be expanded to the north and to the south

No recommendation for land acquisition is included in the park's master plan, however.

In addition to the above, *An Appraisal of Potentials for Outdoor Recreation Development in Barren County, Kentucky* was released in 1972. Two studies relating to the feasibility of establishing a major vacation complex near the park have been completed in the past year.

If and when the aforementioned regional developments are carried out, park visitation is likely to rise faster than the master plan forecasts because more people will be attracted to the region and they will be staying longer.

The Park

Mammoth Cave National Park was established some 30 years ago (July 1, 1941) and now covers 51,354.40 acres of land. This land had been farmed, grazed, and logged for over a century and a half. Since the park's establishment, annual deposition of tons of silt in surface and underground streams, because of old-fashioned farming practices, has been checked, soil fertility has been improving as the forest cover develops, and the scenic beauty of the area has been enhanced.

Visitation to Mammoth Cave National Park in 1970, was 1.7 million. This figure is calculated from mechanical traffic counters on Ky 70 and "Old 70" within the park. Of these, it is estimated that about a million visits were "incidental," i.e., they represent motorists and truckers who were traveling across the park on Ky 70, probably without stopping. Though bearing a State route number, this road was built and is maintained by the National Park Service. Of the remainder, 611,000 took cave tours; 85,000 took the sightseeing boat trip; some hiked or rode horseback on the trails; some fished in the rivers. Actual records of cave patrons have been kept since 1942. Patronage of lodging facilities and passenger counts on the sightseeing boat are maintained by the concessioners. Most cave visitors (70 percent) spend up to four hours in the park which is time enough for a cave trip, a boat ride, a leisurely picnic or meal, or a hike in the woods.

Travel in the 1960's was double that of the 1950's. June, July, and August account for 70 percent of the year's travel; though holidays and weekends during spring and autumn bring heavy use, which is taxing surface facilities and overloading cave trips.

Meanwhile, other recreation opportunities exist in the park which could accommodate more visitors, especially if facilities, such as new hiking trails, were built. The sightseeing boat operated at 65 percent of its capacity in 1970, but more trips can be run and the season could be extended.

Mammoth Cave National Park consists of three zones, each of national significance: Mammoth Cave Plateau, River Valleys, and Hilly Country. These will be described in sequence.

A. MAMMOTH CAVE PLATEAU

1. Natural Resources

Of the three prime park features, the plateau, which comprises the southeast section, is best known to the public. Beneath its ridges and valleys are exceptional lineal cave systems, of which Mammoth is the third longest in the world with 45 miles mapped to date. Mammoth Cave Ridge is about a half mile wide and more than 3 miles long. Flint Ridge is about 2 miles wide and more than 3 miles long. Under it, some 85 miles have been surveyed,

making this the longest cave in the world.* Joppa Ridge contains caverns of unknown extent beneath a surface area as much as 2 miles wide and about 3 miles long. By this writing (1972), about 7 miles of one of these caverns, Lee Cave, discovered in 1968, have been mapped. Nearly every type of cave formation is displayed in the park. There are also a number of underground streams of which Echo and Roaring Rivers in Mammoth Cave are best known to the public. A stream in Flint Ridge discharges at Pike Spring at the edge of the Green River. Ground water has been traced a distance of 7 miles from several of the sinking streams on the Sinkhole Plain, beneath the Plain to Mill Hole, thence to Cedar Sink, and then to the springs in the Green River at Turnhole Bend.

In addition to the cave passages, visitors find the land surface fascinating with its many sinkholes, lack of surface streams, rock-capped ridges, forests, overgrown fields, and varied wildlife.

The three northwest-trending, cave-bearing ridges are bordered by three major solution valleys — Woolsey, Doyel, and Houchins — which are up to 300 feet deep and are rimmed by discontinuous cliffs 100-150 feet high in places. The solution valleys are underlain also by cave passages of unknown extent. Many cannot be explored because they are wholly or partly in the phreatic zone. Elevations vary from about 425 feet in Cedar Sink to 902 feet at Little Hope Church near the park's eastern boundary. In all, Mammoth Cave Plateau is about 23,000 acres in extent or 45 percent of the total park.

Once the Green River and its tributaries flowed across the Mammoth Cave Plateau on top of the Big Clifty Sandstone. The tributaries entering the Green River from the south drained a large area called the Pennyroyal Plateau. In time the erosion-resistant sandstone was breached and the water table dropped as the Green River lowered its bed. Concurrently, water from the Pennyroyal found its way underground and flowed through solution passages it formed in the limestone. These are the dry cave passages tourists

* On December 1, 1972, the National Park Service announced that Cave Research Foundation explorers had discovered a connection, beneath Houchins Valley, between Mammoth Cave and the Flint Ridge Cave System. This confirms a belief long held by those familiar with the cave passages in the park, and it required uncommon courage, great stamina, and years of exploration to achieve this discovery. Water in an underground stream, Echo River, was barely low enough when the connection was made for the explorers to wade through. The combined length of passages now surveyed is 144.4 miles and many more miles will be added as exploration continues. The next longest cave in the world is Holloch Höhle in Switzerland, 71.8 miles, less than half the length of the Mammoth-Flint Ridge Cave.

visit today. The valleys, which separate the ridges of the Mammoth Cave Plateau, are the result of solution and subsidence.

Beneath the surface of the park are several trunk conduits which carry drainage to the Green River from the Sinkhole Plain, the northern part of the ancient Pennyroyal Plateau. Much of the Sinkhole Plain is in agriculture and contaminants may find their way into the cave systems of the park through the several trunk drains. These discharge into the Green River at seven or more big springs along its banks or in its bed. The Sinkhole Plain is a 100,000 acre area to the south of the park where agriculture is the predominant land use, at present, and it is crossed by highways, the main line of the L & N Railroad, natural gas pipelines, and water mains.

Capping the ridges for the most part, is the Big Clifty Sandstone, 50-120 feet thick. Below it is the limestone of the Girkin Formation, 95-190 feet thick. Beneath that is the Ste. Genevieve Limestone, 180 feet or more in thickness. It contains the cave passages which were formed at different levels as the Green River lowered its bed. This process is continuing.

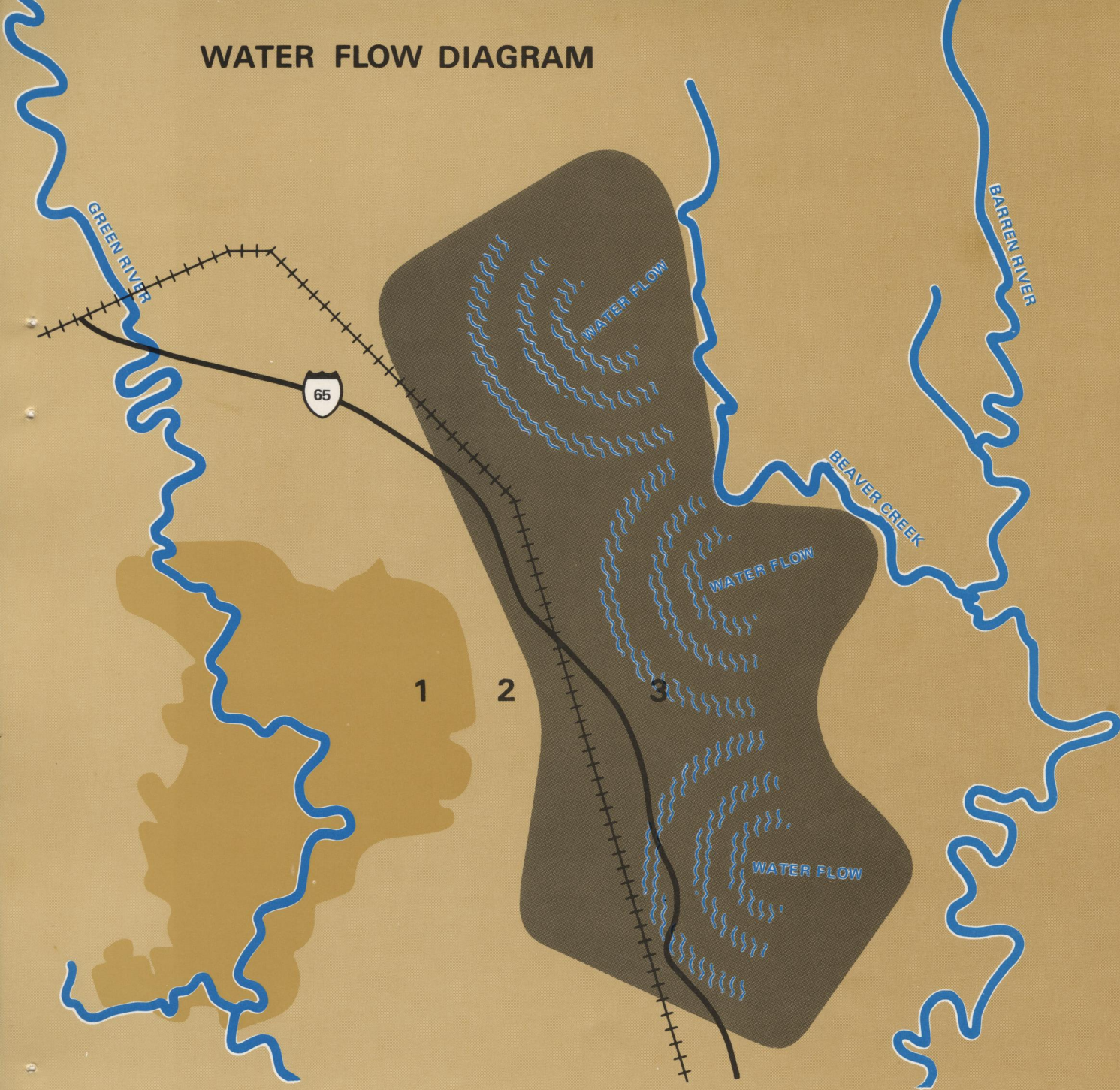
Not only is the Big Clifty erosion resistant, it is also impermeable to water. Hence, rainfall moves outward to the perimeter of the ridges where it drops into vertical shafts or flows a short distance into sinkholes in the solution valleys. The perched water table on Flint Ridge owes its existence to porous rocks and soils overlying the Big Clifty. The water emerges as springs. These have been tapped to provide the major sources of domestic water for the park.

The caprock also protects the caves from physical damage. The ridge tops are good locations for roads and buildings, except that oils and tars from vehicles deposited on road surfaces and washed off by rainfall may enter the caves eventually. Moreover, atmospheric contamination from combustion (emissions from vehicles and heating plants) may enter the caves in winter when the dry outside air is inhaled. Caves exhale in summer.

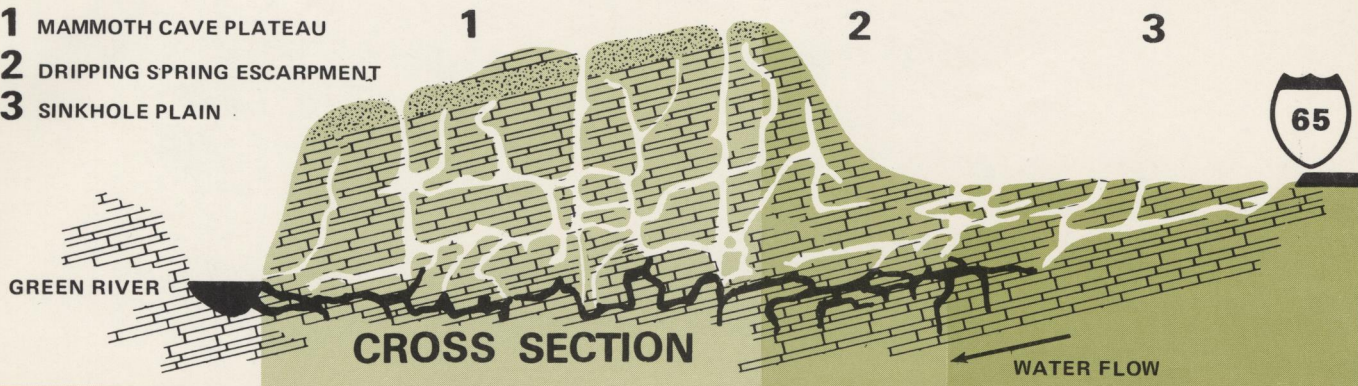
The water table was raised when the Corps of Engineers completed, in 1907, the uppermost of a series of six locks and dams on the Green River to improve navigation and this caused some cave passages to be flooded. Those just above the water table are flooded periodically, when the Green River rises. These passages and those near the perimeters of the ridges may contain dripstone or flowstone formations. The dry passages under the caprock have carbonate and sulfate minerals deposited on the ceilings and walls.

The very long horizontal passages, elliptical or canyon-like in cross section, are best known to visitors. A spectacular example is Cleveland Avenue in

WATER FLOW DIAGRAM



- 1** MAMMOTH CAVE PLATEAU
- 2** DRIPPING SPRING ESCARPMENT
- 3** SINKHOLE PLAIN



Mammoth Cave which is 1.5 miles long, averaging 40 feet wide and 15 feet high. Throughout the caves, passages join and diverge on at least five different levels. Among the distinctive features of the caverns are the vertical shafts, called domes or pits, which resemble the interior of a silo. They are of all sizes, up to 40 feet or more in diameter and 130 feet in height. Mammoth Dome and Bottomless Pit are typical of these shafts.

In all, some 200 kinds of animals are known in the cave passages of the park, including two species of "blindfish." Some live in total darkness, high humidity, and 54 degrees constant temperature; others may leave the cave for varying lengths of time and return to it. For many animals, the only source of nutrients is washed into the cave by water. Any change in the environment, especially in the quality and quantity of water, could destroy whole communities of cave life. About a third of the animals have been isolated from other cave systems for over a million years. A shrimp, a beetle, a pseudoscorpion, and perhaps a book louse and a millipede are found only in the central Kentucky karst. Once extirpated, they could never be replaced. The Indiana bat, an endangered species, utilizes certain caves in the park.

Water of the proper quality and quantity is basic to perpetuation of the animal and plant life in the caves, to maintain the humidity, and to the geologic development of the cave passages. In this region of 50 inches annual rainfall, there are few surface streams, for water disappears quickly underground through sinkholes, swallow holes, cracks, and fissures.

The ease with which visitors view Mammoth Cave belies the physical stamina and uncommon courage required of those who enter wild cave passages. Those who do so face great danger, they often suffer physical torture and experience sheer exhaustion while crawling over sharp rocks and through mud, while wriggling through crevices, while climbing precipices, or descending into deep pits. The constant 54 degree temperature and high humidity sap one's strength, and combine with the stygian blackness to form an environment inhospitable to man.

Living on the surface of the Mammoth Cave Plateau are communities of plants and animals which include 84 kinds of trees, 28 varieties of shrubs and vines, 29 types of ferns, and 209 wildflowers. The cedar karren and savannas of the solution valleys are picturesque and of special interest to scientists. Some species of plants and animals have been introduced by man. Of the 41 kinds of mammals, Virginia white-tailed deer, raccoons, opossums, grey and red foxes, grey squirrels, rabbits, woodchucks, chipmunks, skunks, and bats are observed frequently. Deer are live-trapped and released elsewhere in the State in an effort to keep the herd within the limits of its food supply. There

are 203 species of birds, 18 kinds of reptiles, and 15 amphibians. Invertebrates are numerous; chiggers, ticks, and flies are pests to man and beast.

Fossils are generally distributed throughout the rocks of Mississippian Age. They include brachiopods, crinoids, corals, etc. There are no places where fossils are concentrated and no unique forms have been found, according to the U.S. and Kentucky Geological Survey staff geologists who have studied the area.

2. Cultural Resources

Pre-Columbian Indians of four cultural periods occupied the area of the park: Mississippian, Woodland, Archaic, and Paleo-Indian. These peoples hunted in the area that is now the park and lived in cave entrances, beneath rock shelters, and near riverbanks. No sites have been identified in solution valleys or on ridge tops. Evidence of Indian activity, if indeed it had occurred there, has probably been erased by post-Columbian agriculture and erosion. Woodland peoples practiced primitive agriculture on river floodplains. They also penetrated as far as 2 miles into cave passages where they chipped gypsum and mirabilite from the walls. Two mummies have been found, and numerous human feces have been analyzed to determine the diet of these people. Sandals, bags made of twine, reed torches, etc., remains of campfires, smoke smudges on walls and ceilings, and prints of bare feet preserved in the mud, are among the evidences of Indian use and activity underground. Much evidence of Woodland Indian activity has been observed in Salts Cave. T. G. Sloan and Douglas W. Schwartz of the University of Kentucky did considerable field work in the park, surface and underground, during the summers of the late 1950's. Their manuscript (1960) titled *Archeological Survey of Mammoth Cave National Park, Kentucky* is in the park's files. Much more recent archeological work has been done by Patty Jo Watson and she has published extensively.

Mammoth Cave was discovered by modern man about 1798. Tradition credits a hunter who stumbled upon the cave's only natural entrance while chasing a wounded bear. This opening is known today as the Historic Entrance.

Subsequently, someone noted that the dirt on the floor of the cave was rich in saltpeter used in the manufacture of gunpowder. With the advent of the War of 1812, exploitation of Mammoth Cave began. The rich "peter dirt" was mined and the saltpeter was leached from it. Cave visitors today see some of the relics of this period including wood pipes made by drilling holes lengthwise through straight yellow-poplar logs up to 30 feet in length and 6-8 inches in diameter, and leaching vats. This industry began in 1809 and flourished for nearly a decade, ending after the close of the war.

Visitors hearing of the immensity of the cave began to come and public tours guided by Negro slaves started in 1816. The guides explored deep into the passages and found many wondrous things. In time, Mammoth Cave was extolled as the seventh natural wonder of the world. Trails, bridges, ramps, and stairways were built to improve the footing for visitors. This construction often required blasting.

People arrived after many days' journey on foot or horseback over dusty or muddy roads and had to have lodging and food. Hence, the saltpeter miners' log cabins became the nucleus of a hotel and such accommodations have been provided ever since. Fire destroyed the hotel at least twice over the years and the present "Old" hotel at Historic Entrance dates from 1925 with additional construction in 1930. Alterations were made in 1936 and 1940, and the building was acquired by the National Park Service in 1941. It is a two-story frame structure with basement and a one-story addition all resting on a concrete foundation measuring approximately 33' x 283'. A one-story screened porch with hipped roof extends partially across the front. The building has clapboard siding and an asphalt shingle roof. It appears to be well maintained, but there is some unevenness of the first and second floors that could indicate deterioration of the structural members. Architecturally, it is fairly typical of rural hotels constructed during the same period.

Today, the basement level contains the national corporate offices of National Park Concessions, Inc. This firm is the principal concessioner in Mammoth Cave National Park. It operates the Old Hotel and other lodgings, food services, curio sales, automobile service station, camper's store, and a transit system in the park. The Old Hotel contains 46 guest rooms on the first and second floors, a craft shop, and a snack bar.

Dr. John Croghan, seeking a cure for tuberculosis, established a hospital in Mammoth Cave in 1843. Two of the patients' roofless stone huts, erected in the cave, remain today. The experiment was not successful.

Searches for entries into Mammoth Cave at the east end of the ridge began in 1915. These culminated in 1921 with the formation of the Mammoth Cave Development Company, which opened New Entrance that same year. This entry is about 3 miles east of Historic Entrance. It descended the side of King Solomon's Dome through a series of tunnels blasted in the limestone, ramps, and stairways. From Grand Central Station, at the bottom of the descent, trails were constructed into passages nearby and visitors were conducted on tours. On March 12, 1923, the wondrous area named Frozen Niagara was discovered and trails were extended to it. The following year, the Frozen Niagara portal was opened enabling visitors to descend King Solomon's Dome and exit through the Frozen Niagara section without

retracing their steps. For the benefit of its cave patrons, the Mammoth Cave Development Company built New Entrance Hotel in 1923 containing 25 rooms. Its name was changed to Frozen Niagara Hotel in 1936. The building was razed in 1945. New Entrance was closed in 1967 because of unstable rock and Frozen Niagara portal has been open and in use continuously since 1924.

On Flint Ridge, Colossal Cave was owned and exhibited to the public by the L & N Railroad. Great Onyx Cave and Crystal Cave were developed and shown commercially by their owners. Similarly, on Joppa Ridge, Proctor Cave was opened to visitors. The proprietors of Great Onyx and Proctor Caves built hotels for their patrons. There was great rivalry among cave owners, but Mammoth Cave had received the most publicity and it enjoyed the most patronage.

A casket in Crystal Cave contains the remains of Floyd Collins, an intrepid cave explorer, who became entrapped in Sand Cave while seeking a connection between it and Mammoth Cave. He died on February 16, 1925, before he could be rescued. Floyd is credited with discovering and exploring Crystal Cave on his father's farm. The house near the entrance to the cave, according to tradition, was the Collins' farmstead. Presently this three-room, one-story frame house partially covered with clapboards and vertical boards and battens, and a corrugated metal roof, is in very poor condition. It rests on a foundation of field stone piers laid up without mortar. The wood floors are badly worn, and the sills, wall framing, boards, and battens have rotted.

Near it is a ticket office building, which was constructed many years after Collins' death by a subsequent owner and operator of Crystal Cave. This building is similar architecturally to the "dog-trot" cabin of the southern mountain region having two units separated by a center hall or passage. One unit consists of only one room. The other contains a shower room, dressing room, and toilet rooms. Both units are encircled by a porch and there were benches between supporting log posts. Structurally it is frame covered with clapboards. The hipped roof has a corrugated metal cover, and the foundation is of field stone, walls and piers, some of which have been replaced by concrete block. The porch floor framing and floor boards have deteriorated to a dangerous condition, rot was observed in the clapboards and wall framing, and the roof appears to be in poor condition.

The Old Hotel, churches, Floyd Collins' home, and the Crystal Cave ticket office are the only surface structures remaining in the park from the period of private cave ownership and operation.

Mammoth Cave has witnessed more than a century and a half of visitation. Persons have come on foot, on horseback, in stage coaches, by railroad, packet boat, bus, and automobile. From 1886 until 1931, the Mammoth Cave Railroad Company operated an 8-mile spur off the main line of the L&N Railroad from Glasgow Junction (now Park City) to Mammoth Cave. On exhibit, near Historic Entrance, is the dummy-type locomotive "Hercules" and a baggage-passenger car that were used on this spur line. This train is protected from the elements by a roof and from vandalism by a high wire fence. The alignment of the old railroad grade is now the corridor of the major access road to Historic Entrance.

In years past, the hallmark of Mammoth Cave was its restful atmosphere, following a tedious and rugged journey. Louisville and Nashville, the nearest large cities, were more than a hundred miles away, though they were connected by highway and railroad. Trips in the cool cave, swims in the river, elegant dining, and relaxation on the hotel's veranda made this a vacation destination.

In 1905, a movement got underway, spearheaded by the Kentucky Congressional delegation, for Federal ownership and operation of Mammoth Cave. At the behest of Congress the Southern Appalachian National Park Commission studied the area and made a report to the Secretary of the Interior. The result was an Act of Congress approved May 25, 1926 (44 Stat. 635) which authorized establishment of Mammoth Cave National Park after a minimum area of 20,000 acres was acquired and title vested in the United States in fee simple.

Land acquisition with donated funds was begun by the Mammoth Cave National Park Association, but monies were insufficient and progress slow. Funds were appropriated later by the Kentucky legislature and by the Congress, and negotiations with landowners were undertaken by the National Park Service. On May 22, 1936, 27,402 acres had been acquired and accepted by the Secretary of the Interior and the area was declared a national park on July 1, 1941. Later the Great Onyx and Crystal Cave properties were purchased for the park.

With lands added after 1936, the park now comprises 51,354.40 acres of 70,613 acres authorized. It includes the cave-bearing ridges, segments of the Green and Nolin River Valleys, and the Hilly Country north of the Green and that portion south of the Green which is west of Turnhole Bend.

All land in the park was privately owned. In some cases cave rights were purchased separately from surface rights. On the Mammoth Cave Plateau, as elsewhere in the park, people lived on the land. About 600 families resided

in the area acquired. The flat ridge tops, valley floors, and river floodplains were in crops like corn and tobacco, which depleted the fertility of the soil. Erosion went unchecked. Some lands were grazed. Slopes too steep to cultivate remained forested and these had been logged several times. Mine timbers cut from the forests were shipped by barge down the Green River. There was a network of wagon roads connecting farms to one another and to markets in towns nearby.

At Historic Entrance, there was a hotel and associated buildings, parking areas, a post office, and private residences.

Following land purchase, farming and logging ended, families moved away, buildings and fences were demolished, the forest cover began to return, and erosion was controlled with the aid of Civilian Conservation Corps' projects.

Reminiscent today of the period of private ownership are the "old" Mammoth Cave Hotel; "Hercules" (locomotive) and coach of the Mammoth Cave Railroad; farm house and cave ticket office at Crystal Cave; three one-room frame churches where services are held on Decoration Day each year, and Little Hope Church, on the edge of the park, which holds services weekly; occasional fences, chimneys, wagon road traces, and cemeteries. In Mammoth Cave are: the remains of the saltpeter manufacturing process; walls and ceilings darkened by smoke from workers' and visitors' torches; abandoned trails with their flights of wooden stairways, and countless names, initials, and dates inscribed on the walls of the passages from early times.

There are no cultural sites within Mammoth Cave National Park listed presently on the National Register, but in compliance with Section 2(a) of E.O. 11593 of May 13, 1971, four sites were nominated in 1972 for possible inclusion on the Register. Other sites are being studied. The State Historic Preservation Officer has been contacted and her letter of December 18, 1973 is appended (see p. 186).

3. Recreational Resources

Virtually all public use of Mammoth Cave National Park is confined to Mammoth Cave Plateau. There are motor roads, trails, scenic vistas, forests and wildlife, a picnic area, campground, comfort stations, lodgings, food services, curio sales, amphitheater, visitor center, parking lots — all above ground; trails, a dining area, and comfort stations are below ground.

The public roads on Mammoth Cave Plateau predate the park's establishment. They were deeded to the National Park Service (Deed No. 262, recorded in Edmonson County Deed Book 45, pp. 604-607) with the

stipulation that some of them remain open to the public. In the inventory that follows, those which are subject to this deed reservation — to remain open for public use — are marked with an asterisk. In 1945, this was considered necessary to assure access to inholdings, to churches, and to cemeteries. All inholdings have been purchased. Most church services are now held annually on Decoration Day, but Little Hope Church holds weekly services. Burials are less frequent each year. Some of the roads have been rebuilt to modern standards; most have bituminous pavement; all but two are two lanes wide.

Inventory of the Public Road System on Mammoth Cave Plateau.

a. **Ky 70 on Joppa Ridge** — A modern transpark road, 7.7 miles long, connects with State Highway System at east and west park boundaries; carries commercial, local, and intrapark traffic; built, maintained, and patrolled by the National Park Service; pavement 21 feet wide; designed for a 50-mile speed limit. The wide shoulders are grassy and are mowed regularly.

From Ky 70, motorists get fine views of Woolsey Valley and of Turnhole Bend which contribute to a pleasant windshield experience for truckers, local commuters, and others who drive through without stopping. Should this traffic cause congestion on Ky 70 within the park in the future, it should be rerouted on other roads outside the park to avoid irretrievable damage to park resources.

Mammoth Cave Parkway, a segment of Ky 255, intersects Ky 70 at Chaumont on the east park boundary. This 2.3-mile roadway, completed in 1968 by the Kentucky Department of Highways, is a limited access scenic approach to the park from Park City and its I-65 interchange. Diamond Caverns, one KOA campground, and one private campground are all reached from the parkway.

From Chaumont, most visitors proceed westward along Ky 70 to Sloans Crossing Pond, thence northward on Sloans Crossing Road to "Old 70" on Mammoth Cave Ridge, and then northwesterly to Historic Entrance — a total distance of 6.0 miles. Motorists may reach Chaumont also via Ky 70 from Cave City and its I-65 interchange 5.4 miles east. Between Cave City and Chaumont, the main park entrance, private enterprise operates several souvenir stands, chair lifts, wax museum, pioneer village, cave information kiosks, motels, service stations, and other tourist-oriented businesses.

At Sloans Crossing Pond, along Ky 70, there is a parking turnout and roadside table, and fishing is permitted. Another parking area is located near the intersection of Ky 70 and Ky 422 for visitors walking 0.4 mile to the Turnhole Bend Overlook. There are gravel spur roads leading to cemeteries and to Joppa Church off Ky 70.

b. **Ky 422 on Joppa Ridge** — Modern road near Cedar Sink; 1.2 miles in park; connects Ky 70 with State Highway System at south park boundary; uses same as Ky 70. On this road is a parking area for those who walk the trail 0.75 mile to Cedar Sink.

c. **Joppa Ridge Motor Nature Trail** — This gravel road is one-way only between Mammoth Cave Ferry Road (see below) and Ky 70 near Joppa Church. It is 2 miles long and has 13 interpretive stations keyed to a guide folder dispensed from a box at the start of the motor nature trail off Mammoth Cave Ferry Road. The motor trail was established in 1970 and its popularity is increasing.

d. **Sloans Crossing Road** — Modern intrapark road across Doyel Valley; connects Ky 70 at Sloans Crossing Pond with "Old 70" at Carmichael Junction; 1.6 miles long. Along Sloans Crossing Road is a parking area with an interpretive marker describing Doyel Valley, which is seen well from here. This paved road is 20 feet wide and is designed for a speed of 45 m.p.h.

*e. **"Old 70" on Mammoth Cave Ridge** — Segment "A" extends 3.1 miles from east park boundary to Carmichael Junction; narrow (18-foot pavement) and tortuous to drive because of sharp curves. It has not been rebuilt to modern standards because Chaumont was designated the main park entrance during MISSION 66 planning for the park. Segment "B", 1.6 miles, connects Carmichael Junction with Historic Entrance; modern road. "Old 70" carries mostly intrapark traffic and some commuters.

From the park boundary at "Old 70," motorists may travel eastward over Ky 255 to Turleys Corner (this is not the Mammoth Cave Parkway mentioned above) and then via Ky 70 to the Cave City Interchange with I-65, a distance of 4.7 miles.

Like Ky 70, "Old 70" has many intersecting roads including accesses to Little Hope Church and cemetery; management roads to the Snowball dining room elevator, Mt. McKinley well and storage tank, National Park Service employee residence and utility areas; bus transit system spurs to cave entrances; spurs to the campground, picnic area, campers'

store and service station, and to the hotel; and the following public roads: Cox Store, Sloans Crossing, Mammoth Cave Ferry, and Northtown. "Old 70" terminates in the visitor center parking lot at Historic Entrance.

*f. **Mammoth Cave Ferry Road on Mammoth Cave Ridge** — Modern intrapark road between "Old 70" and the Green River, a distance of 1.2 miles, serves intrapark traffic, consisting mostly of sightseeing boat passengers who drive to parking lot on river bank. North of the river, after crossing by ferry, a gravel road continues to the park boundary where it connects with State Highway System. Also carries commutation traffic.

*g. **Northtown Road on Flint Ridge** — 3.6 miles long, connects "Old 70" on Mammoth Cave Ridge with Cox Store Road along the east park boundary. This 18-foot wide gravel road was surface-treated as far as the Conservation Center to control dust. Spurs lead to Great Onyx Cave, 1.8 miles; to Mammoth Cave Church and cemetery, 0.1 mile; Great Onyx Civilian Conservation Center, 0.75 mile; and to Crystal Cave, 1.2 miles. Several spurs lead off these roads to cemeteries and to springs and wells. Few tourists travel the Northtown Road because the caves are not open to the public; there is little scenic interest; and the east boundary road is a one-lane gravel road.

*h. **Great Onyx Cave Road** — A gravel spur off Northtown Road leads 1.8 miles to the cave entrance. First 1.4 miles, to the old property line, is covered by deed reservation; intrapark use only.

*i. **Crystal Cave Road** — This gravel spur from the Northtown Road is 1.2 miles long, but only the first 0.7 mile is to remain open according to the deed; intrapark use only.

*j. **Cox Store Road** — Connects "Old 70" with a State highway along east park boundary; 1.0 mile; gravel surface; narrow; used mostly by local people to reach their homes, and by school buses.

All the roads described under a. to j. above, inclusive, total 24 miles, of which 12.6 miles are covered by deed reservation. Of these 12.6 miles, 10 miles will be occupied by the transit system roadbed when that system becomes operational from the new peripheral staging area discussed in the master plan. At that time, the National Park Service will petition the court to amend the road deed so that these roads may be converted to transit use. Even then, provision will be made for public access by private vehicles to churches and cemeteries as required.

It will be necessary to close the Joppa Ridge Motor Nature Trail, also, because the Mammoth Cave Ferry Road leading to its eastern entry, will not be open to use by the public in personal cars.

Where heavy concentration of traffic requires, such as the 3/4-mile segment of Ky 70 between Chaumont and Union City, the road will be widened to four lanes with a median and an overpass will be provided (see III.A.2.).

Park Travel Figures

Two sets of travel figures are maintained by the park: estimated gross travel and actual cave entries. The count of actual cave entries has been kept since 1942. Figures for cave and parking lot capacities in the master plan were based on actual cave entries.

Gross park travel in 1970 was estimated at 1.7 million, but 611,000 entered Mammoth Cave. Gross travel is figured by multiplying the vehicle count (from the automatic counters on park roads) by 3.5 persons per vehicle. Vehicle count is adjusted by subtracting an estimated number to compensate for park employees and their families, official vehicles, and delivery trucks which pass the automatic counters, thus arriving at an estimation of actual visitors. This includes about a million visitors who travel across the park on Ky 70 or other roads. Much of this is local and business traffic, but a park facility (roadway) is being used and the transpark drive has high scenic quality. Moreover, motoring is considered to be a very popular outdoor recreation activity.

Observations by the park staff show that 20 percent of the occupants of cars parked by visitors at Historic Entrance parking lots are not on cave trips. They may be waiting for others to return, may be hiking trails on the Green River bluffs, may be dining or buying curios, may be hotel patrons, may be picnicking, may be babysitting, or may be "people watching." Recreational opportunities on the Mammoth Cave Plateau include such things as motoring, picnicking, camping, lodging, nature study (guided and self-guided), hiking, photography, and guided cave trips. The National Park Service and the concessioners provide facilities and services for supporting these and related activities.

All persons entering the cave, age 16 and over, pay a guide fee, as follows:

Cave Tour	Guide Fee
Frozen Niagara	\$1.50
Historic	1.50
Scenic	2.00
Lantern (Wild Cave)	3.50



Grassed areas adjacent to the visitor center and the "Hercules" exhibit are used regularly for overflow parking.



Ruts in the sod adjacent to the visitor center at Historic Entrance caused by overflow parking when the ground is wet.

Visitors walk to and from Historic Entrance, but all other tours require bus transportation for which a fee of \$.50 per person is charged except small children. Guides are provided by the National Park Service and National Park Concessions, Inc. owns and operates the buses.

The following analysis suggests the extent of the impact of the present visitor load upon facilities and services and park resources both surface and underground.

Of the 611,000 visitor entries to Mammoth Cave in 1970 (by contrast, there were 388,015 in 1965), seventeen percent use the campground and 11 percent stay overnight in the lodging units. About 80 percent of these visitors stay only one night. Nearly 70 percent of the cave visitors come during June (15 percent), July (20 percent), and August (28 percent) and remain in the park four hours or less. Weekends, Tuesdays, and holidays attract the most visitors.

The majority are in the park between 10 a.m. and mid-afternoon. The largest number of cars is in the parking lot about 2 p.m. These loadings have held constant for several years. On peak days there are in excess of 6,000 cave visitors and such days are becoming more frequent all during the year. The peak day to date was July 2, 1972, Sunday, with 8,013 cave visitors. Overcrowding of the parking lot and visitor center and excessive numbers on cave trips first became noticeable in 1967 with the situation worsening ever since.

The paved parking spaces at Historic Entrance are filled when there are 3,414 visitors in the cave. The visitor center is overcrowded with 4,000 cave visits per day. If travel continues to increase during the next 30 years as it has during the past 10 a reasonable projection is about 13,265 average daily cave visits in August 2000, or more than two and a half times greater than in August 1970 when there were 5,130.

During the period from June 13 to September 7, 1970, there were more than 3,400 visits each day except for the five-day period between August 30 and September 5 (the first week of school) when there were fewer than 3,400 visitors each day. Between July 1 and September 7, there were 12 days when cave visits exceeded 6,000, including July 4 when there were 6,501 and September 6 when there were 6,729. Recalling that paved parking accommodates 3,414 visitors and the visitor center is crowded at 4,000, it is apparent that congestion occurred almost daily through the 1970 summer season.

When the paved parking spaces are filled, cars overflow into the picnic area, onto the road shoulders, median strips, and the grassed areas between the visitor center and the Hercules exhibit near the automotive service station. Such parking is congested and destructive to the environment. Cars become mired frequently when thunderstorms occur. Towing them out ruts the grass; oil drippings kill it; and contaminants are washed into the cave or the Green River. Such conditions will become worse unless corrected.

During 1970, 54 percent of the cave visitors participated in the Historic Tour which is semi-self-guided in summer; 1 percent took the Lantern Tour; and 45 percent saw the Frozen Niagara section. Of the latter, 24 percent elected the Frozen Niagara tour, which requires a round trip by shuttle bus from the Historic Entrance staging area, and the other 21 percent took the Scenic Tour, which exits from the Frozen Niagara portal.

On a summer afternoon, 200-400 persons on a guided cave trip is of common occurrence. People are rushed through with few stops for explanation by guides. Party size is a function of visitor volume at a given time, numbers of trips available then, and size of guide staff. More guides, more cave trips, and more lighted passages would accomplish nothing towards solving the problem of automobile storage on the surface. The master plan identifies solving this problem as the first order of priority.

Utilities

From early times, Mammoth Cave Hotel had used spring water. It was readily available and of high quality. As park use of domestic water increased, it was logical to develop more of the springs on Flint Ridge which drain the perched aquifer in the Haney limestone. A water shortage in August 1962 required hauling water by tank truck to supplement the collections from five springs and one well, then in use. Water from springs flows normally a short distance on the surface and then disappears into the cave system through cracks. During periods of low flow virtually the entire flow of some springs is diverted from the caves to the park's domestic supply. Presently, the system collects water from eight springs and two wells; a third well was drilled on Mammoth Cave Ridge. Wells tap the basal water table. Storage tanks on Flint Ridge have a capacity of 1,200,000 gallons and the tanks on Mammoth Cave Ridge hold 550,000 gallons. A full and complete discussion of present and future water supply is contained in Geological Survey Water-Supply Paper 1475-Q.

About 27 million gallons of water are consumed annually: about 25 percent each by National Park Concessions, Inc. and the Conservation Center, respectively, and the remainder by all other park uses including the campground, public comfort stations, employee residences, etc. The bulk of

the water comes from springs because the yield from wells is low, the water quality is poor, and it is high in sulfate. The amount of water available from these sources is lowest in late summer and early fall. At times, during this period of the year, practically all the available surface flow of spring water is collected and pumped to storage tanks on Flint Ridge. The major springs have all been diverted so only very limited expansion of yield is possible by tapping ground water. However, additional storage could provide a further cushion for periods of low flow.

The master plan recognizes the problem of increasing the supply of water to meet the increasing visitor load, and the damage to the Flint Ridge Cave System by perpetuating the present collection system. The plan suggested two alternates, viz. purchasing from a water district, or tapping the Green River in the park. The former would probably be much less expensive than the latter because extensive treatment of Green River water would be required. The intake structure, treatment plant, and associated works would consume considerable acreage, electrical energy, and be a visual intrusion.

At this writing, both the Edmonson County and the Green River Valley Water Districts appear to have ample reserves and treatment plant capacity to supply the park's needs. Edmonson County water comes from the Green River just upstream from Brownsville. The Green River Valley District draws its supply from Rio-Verde Spring. Water from Edmonson County's plant would be piped along Ky 70 to the west park boundary at Silent Grove Church; from there a 7.5 mile pipeline would be required to connect with the park's distribution system. Green River Valley Water would be piped along Ky 70 west from Cave City to Chaumont on the park's southeastern boundary in a 10" main. From there, a 6" tap would continue along Ky 70 to Union City, then cross Doyel Valley and connect with the park's system at Mt. McKinley well on Mammoth Cave Ridge, 2.2 miles from Chaumont.

Plans for forming a water district in Barren County are underway. Its water would be drawn from Barren River Lake. If these plans materialize, this would be a third potential water source for the park. The water main would probably serve Park City and then follow Mammoth Cave Parkway to Chaumont.

Expansion of the local water districts has other implications. Water has constricted development in the past at Park City, which has been dependent on wells. These have a very low yield in summer and fall when demand is heaviest. Cave City, on the other hand, has been blessed with abundant water drawing it from the Green River District. Hence much development has sprung up at the I-65-Ky 70 interchange adjacent to this town. Further expansion there is contemplated by a group of developers considering a

massive recreational complex on 165 acres of land. This would be a theme park of the Disneyland-type requiring a capital investment of more than \$28 million. On land adjacent to it, the developer is also considering a motel, convention center, and other commercial establishments.

In a study prepared for the Economic Development Administration released in April 1971, it was determined that Cave Country had

- an inadequate visitor holding capacity
- a present tourist pattern that is dispersed
- an absence of major commercial attractions

Among the constraints on such development, recognized in the report, was the lack of water and sewer facilities.

Limited access to Mammoth Cave Parkway (Ky 255), between I-65 and Chaumont, will be the only way to prevent "strip" development along this scenic approach to the park when more water becomes available. The Diamond Caverns' property straddles this road now with the cave operation on the east side and a 500-site KOA campground on the west. When additional water becomes available, the owner could expand his business and this would help to relieve camping pressure on the park.

Similarly, Ky 70, both east of the park towards Cave City and west of the park towards Brownsville, will be paralleled by water mains some day. When this happens, it will relieve one of the constraints on development and could spark the establishment of many tourist-oriented business enterprises. If these are done tastefully, they could be an asset to the park and region, but collectively, they could become just another neon strip, common throughout our land.

Availability of abundant water now (1973) is timely for Brownsville because Ky 70 will bring travelers to it and the park from Green River Parkway which connects Owensboro and Bowling Green.

> The other constraint on regional development is lack of a sewer district in the portion of the area underlain by cavernous limestones. There, water goes underground rapidly and finds its way into underground streams. If this water reaches the caverns of the park in a polluted form, the physical appearance of the passages could be altered, the live creatures therein could be harmed, or destroyed, and foul odors would be unpleasant and unhealthful to visitors. This points up the necessity for cooperative effort on the part of the Commonwealth of Kentucky and the counties in monitoring and controlling, if need be, the extent and type of development in karstic areas to assure compliance with measures for adequate treatment of waste water.

In-park sewage collected from the Historic Entrance area, the comfort station in Great Relief Hall of Mammoth Cave, and park residence and utility area is treated at an Imhoff tank, coupled with trickling filter, final clarifier, recirculation, chlorination, and sludge drying beds, near the Green River. This plant's capacity is 120,000 gallons per day. There are two comfort stations in Mammoth Cave — at Snowball and Mount McKinley — from which the effluent is pumped to the surface and disposed of by spray field and by septic tank, respectively. Three lagoons plus an overflow line to the Green River handle the sewage from the Great Onyx Civilian Conservation Center. A septic system serves the Cave Research Foundation's dormitory on Flint Ridge. All these systems are approved by Federal and Commonwealth water pollution control officials, though there have been some operational problems which have been corrected.

The presence of underground gasoline, fuel oil, and diesel oil storage tanks, and sewer tanks and sewer lines on Mammoth Cave Ridge and Flint Ridge poses some physical threat to the caves and to life in the caves if leakages should occur. There is some danger, also, from similar installations on the Sinkhole Plain outside the park.

In April 1966, near Trenton, Georgia, leakage of 160 gallons of gasoline from a filling station storage tank was carried by an underground stream to a pit in Howard's Cave. The gasoline was ignited by the flame from a carbide lamp worn by one of a party of cave explorers. The resultant explosion and generation of carbon monoxide gas caused three persons to lose their lives. A lethal concentration of gas was still present in the cave 10 days later. Gasoline tanks holding several thousand gallons each are buried at two locations on Mammoth Cave Ridge and at one location on Flint Ridge.

Fuel and diesel oils, while not as volatile as gasoline, would leave stains which could never be removed and would be harmful to cave life if leakage occurred. Fuel oil is used for heating government and concession buildings on Mammoth Cave Ridge and trailers occupied by the staff at the Conservation Center on Flint Ridge. A 4,000-gallon underground diesel oil storage tank is located at the Conservation Center.

Sewage effluent overflowing from the first lagoon built at the Conservation Center is known to have entered the cave system beneath. The effluent killed vegetation in a narrow strip along its path and went underground into a fissure after flowing about 100 yards on the surface of the ground. This was corrected by the addition of two more lagoons and piping the chlorinated effluent to the Green River. Chlorine treated effluent also overflowed from a cleanout valve on the surface overflow line when a stoppage occurred. This was not toxic when it went underground.

➤ Again, the threat of sewage pollution in the caves is not confined to park sources, but might occur from a point outside. Industrial sewage dumped several years ago into a sinkhole on the Sinkhole Plain near the town of Horse Cave, Kentucky, polluted the stream flowing through Hidden River Cave and forced its closing to public tours. It has not been reopened because the odor still lingers.

While all the incidents cited above might be termed "accidental," there is presence of danger to the cave system from sources within and outside the park boundaries.

4. Great Onyx Civilian Conservation Center

Located on Flint Ridge, about 3.7 miles northeast of Historic Entrance via Northtown Road, this center is operated by the National Park Service for 214 disadvantaged young men recruited mostly outside Kentucky by the Office of Economic Opportunity, now under the U.S. Department of Labor.

Although the site of the center had been occupied by one of the Civilian Conservation Corps Camps in the late 1930's and early 1940's, none of the structures remain. The functions of the center are housed mostly in buildings of temporary mobile construction, though there is an internal paved road system and sidewalks. The center has its own utility systems — water, sewer, electricity, and telephone. The total government investment in the center's structures and utilities is about \$1.5 million.

The Great Onyx Civilian Conservation Center was activated on June 15, 1965 after approval of the site by the Governor of Kentucky in accordance with Section 109 of the Economic Opportunity Act of 1964, Public Law 88-452, and after agreement between the Director, Office of Economic Opportunity and the Secretary of the Interior on January 15, 1965 under authority of Subsection 103 (a) of the act.

An educational staff provides instruction in the "three R's," and there is on-job work training in several of the manual skills. This program is designed to give the corpsmen learning opportunities so they may qualify themselves for the labor market.

Work projects are conducted in the center itself, in nearby communities, and for the National Park Service. Among the latter were the construction of a new ferry boat, deer traps, trailwork in Mammoth Cave, spring development, boundary survey and marking, water and sewer lines, road improvements, landscape plantings, vista clearing, frame and masonry building construction, and fighting forest fires.

During FY 1969, the center expended about \$1.6 million for salaries, supplies, etc. and conducted improvement projects in nearby communities, at the center itself, and for the National Park Service at a cost of \$137,270 and with an appraised value of \$304,687. In general, about 6 percent of the center's work program has been for communities nearby, 35 percent has been devoted to rehabilitation and improvement of the center itself, and 59 percent have been conservation projects within the park.

Unquestionably, the presence of the center has a strong influence on the local economy, but suitable work projects for the corpsmen are becoming fewer. The backlog of park conservation projects is almost exhausted and community projects have been sought in order to maintain the staff and program. In FY 1972, the level of community work was higher than any year since FY's 1966-67. It is doubtful that the combined load of work projects — community, in-center, and park — can sustain the center much longer. Aside from other considerations, this may force the center's relocation.

Corpsmen also engage in recreational activities in the center's gymnasium and on its playing fields, arts and crafts, off-site trips to nearby communities, and may receive weekend passes and home leave.

When the center was established additional springs on Flint Ridge were tapped to provide water for domestic use. Of the 27 million gallons used in the park annually, about 7.2 million gallons are delivered to the center, or about 60 gallons per day per person.

All the buildings at the center are heated electrically, but the staff and their families who live in trailers, heat them with fuel oil stored in 800 gallon tanks. Most of these are buried beneath the ground as are both of the 4,000-gallon gasoline and diesel oil storage tanks in the center proper. Petroleum products leaking or spilled accidentally could find their way into caverns or underground streams with the potential of great danger to cavers, and permanent damage to walls and ceilings because the stain could never be removed.

The master plan calls for the complete removal of all man-made structures required for the operation of the center on Flint Ridge, restoration of the original contours, and re-establishment of natural vegetation.

B. RIVER VALLEYS

1. Natural Resources

The Green and Nolin River Valleys comprise the second of the three zones in the park. The former, a major tributary of the Ohio, bisects the park from

east to west for 26-miles. Six miles of the Nolin cross the park. Its waters enter the Green from the north near the park's west boundary. The Green varies in width from 50 to 300 feet and is subject to 50-foot flood crests. Valley slopes, flood plains, and islands are densely forested with hardwoods, though pure stands of Virginia pine cover some former farmlands on the floodplains. Along both the Green and Nolin are some of the most outstanding riverscapes in Kentucky. These streams provide a highly scenic access to some of the most primitive lands of the park, and much wildlife may be observed along them.

By an Act of the Kentucky Legislature, approved March 23, 1972, the Green River segment across the park was designated a "wild river." The effect of this act upon park operations is open to conjecture at this writing. Having deeded the lands in fee simple and ceded jurisdiction, the Commonwealth may not have the authority to impose controls legislatively upon a Federal function.

The river valleys generally resemble primitive conditions more closely than any other lands in the park. Sheer cliffs of limestone along the Green, sandstone conglomerate along the Nolin, densely-forested valley slopes and islands, and overhanging sycamores and elms on the banks have not changed much visually over the years. Occasionally a shadowed opening in a cliff marks the entry to a shallow limestone cave. River banks are generally steep and muddy because of deposition of alluvium during floods.

In addition to sycamore and elm, other common forest trees are river birch, box-elder, willows, cottonwood, American beech, maples, oaks, hickories, hackberry, and yellow-poplar. The mature forest (some say it has never been logged) in the vicinity of Historic Entrance contains species of trees typical of the mixed mesophytic forests which grow on such limestone bluffs along Green River.

Seen frequently are deer, beavers, muskrats, turtles, ducks (including the colorful wood duck), and songbirds. Bass, catfish, muskellunge, and carp are common fishes.

The rivers, ages ago, meandered across the Mammoth Cave Plateau. As the land rose, the meanders deepened and the river bed is now some 300 feet below its former level. Of considerable geologic interest is the hill called Goblin Knob, formed when the Green River cut across the neck of a meander. A classic example of an incised meander is Turnhole Bend. A fine view of Turnhole Bend on the Green River may be obtained from Ky 70 about 0.5 mile west of its junction with Ky 422. Here the road crosses a valley on a deep fill providing the elevation necessary for viewing this part of the river valley.

From Turnhole Bend eastward, no surface streams tributary to the Green enter it from the south, because their valleys were pirated when the Green lowered its bed faster. Former stream channels remain as hanging valleys. Instead, tributaries from the south enter the Green in the form of seven large springs along its bank or in its bed. These springs are at the mouths of underground conduits which pass through the limestone and carry drainage from as far away as the Sinkhole Plain. Turnhole Spring is the largest and most spectacular of the resurgences in the park. Pike Spring, and the outlets of River Styx and Echo River which drain Mammoth Cave, are well-known also. Former conduits, now dry, are the cave passages tourists visit today. In Mammoth Cave, the passages are on five different levels indicative of stages in the lowering of the river bed.

A swampy area, located on the south side of the river just upstream of Houchins Ferry where a tributary enters the Green, is a rather unusual habitat for the park.

There are many forested islands in the Green River, all subject to inundation by floods. Huge piles of debris — tree trunks, old tires, and other trash — are deposited at the upstream end of these islands when the water recedes. Sometimes, narrow channels adjacent to islands are blocked when trees topple over which have been undermined by the current.

In the Nolin River Valley is picturesque First Creek Lake, about 5 acres in size, located on the floodplain.

At the mouth of Bylew Creek, a tributary of the Nolin, is a beautiful display of ferns at the base of a cliff. Nearby is a collection of plants which is a relict of the Ice Age or a still earlier period. The microclimate here is favorable to the perpetuation of this disjunct mesophytic community. The most conspicuous plant of this habitat is eastern hemlock, growing here 100 miles west of its nearest contemporaries in the Cumberland Mountains of eastern Kentucky. Similar habitats have been discovered recently in the Cubby Cove, First Creek, and Wet Prong watersheds, on Robbins Branch, and on the flanks of Indian Hill. At each of these stations, the Caseyville Formation, a sandstone conglomerate, is exposed. On the east side of the Nolin at Cubby Cove, the combination of brown sandstone cliffs and associated vegetation is spectacular.

2. Cultural Resources

Canabrakes along the rivers remind one of the periods of Indian use and occupancy of the land now in the park. Torches fashioned from canes illuminated trips into the caves to chip gypsum and mirabilite from the walls. Sunflower, marsh elder, chanopod, squash, and gourd plants were cultivated

on the floodplains and the seeds of all, but the last named, were used for food.

Along the rims of hollows back from the river, 17 rock shelters have been found, and eight village sites have been located mostly on the floodplain. These discoveries were made in the late 1960's by University of Kentucky archeologists. Little surface archeological exploration has been undertaken in Green River Valley outside the park.

Modern man cultivated the floodplain, too. In places, dense growth of Virginia pine has covered these old fields, and they are conspicuous from the air. In general, growth on the floodplains is so dense that foot travel is from difficult to impossible, especially during the growing season.

To aid navigation on the Green and Nolin Rivers, the Corps of Engineers built a series of dams and locks. The sixth and uppermost was completed in 1907 near Brownsville. This impounded 17 miles of the Green, and slackwater extends from the dam to mile 199 at the upper end of Floating Mill Island, and slackwater on the Nolin extends more than 6 miles to a point above Kyrock. Pool level is at 421 feet elevation. Water thus backed up by the dam at lock 6 caused the lowermost passages of Mammoth Cave to be flooded.

Barges were loaded with rock asphalt from mines near Kyrock on the Nolin. Barges also transported mine timbers cut from the forests along the Green. Packet boats plied the Green River bringing visitors to Mammoth Cave from as far away as Evansville, Indiana where the Green flows into the Ohio. The names Turnhole Bend and Turnhole Spring came from packet boat days when boats nosed into the spring to turn around. A popular excursion from Bowling Green included a 10-hour run on the river to Mammoth Cave and return by railroad. The steamboat era ended in 1917.

As resources were depleted and markets declined, shipping slowed down and had practically ended when a disastrous flood in 1951 washed out dam 4 on the Green River ending commercial navigation. The same year, the Corps of Engineers deactivated lock 6. There are no plans now to restore navigation to the Green River above dam 4.

The Corps of Engineers has erected two flood control dams which affect park waters. Just north of the park is Nolin Dam, built in 1963, which formed Nolin River Lake. Upstream on the Green, 100 miles east of the park, is Green River Dam and Lake dating from 1969. The Corps states that the Green may still be subject to 50-foot flood crests.

Boating and camping in the river valleys will be discouraged during April when floods are most prone to occur. Occasionally, there is local flooding when sustained rainfall occurs in the watershed. The danger is from floating objects, from blocked channels, from swift water, and from rising water. It is greatest near dam 6, on the Nolin, and on the uppermost stretches of the Green. Danger decreases where the river is widest, from about the mouth of the Nolin upstream to Turnhole Bend vicinity. When floodwaters recede, great quantities of tree trunks and debris form huge piles at the upstream end of the major islands. This wood, when dry, is an excellent fuel for campfires.

Before the park's establishment, there were several ferries across the Green and Nolin Rivers connected with the network of wagon roads used by farmers and loggers. The U.S.G.S. Mammoth Cave quadrangle sheet, published in 1922, shows eight ferries on the Green and one on the Nolin. These ferries all had wooden hulls and carried passengers, horses, and wagons. In addition to the ferries there was one ford (Doyles) near Goblin Knob. All are closed now except for Houchins and Mammoth Cave ferries and their connecting, cross-park roads which must remain open, by deed reservation, for the "usual use by the public." The vessels have been replaced over the years and now have a steel hull and are driven by a gasoline engine and side paddle wheel. Each carries three vehicles, passenger cars or light trucks, per trip. The ferries and their 1970 traffic count was as follows:

Name of Ferry	Vehicles	Passengers
Mammoth Cave	42,829	96,856
Houchins	11,647	26,496
Total	54,476	123,082

The column headed "passengers" represents the number of people crossing in vehicles. Persons rarely traverse these roads on foot and use the ferry to cross the river.

During the summer, about two thirds of the traffic using Mammoth Cave Ferry is by commuters and official vehicles; over Houchins Ferry, 85 percent is commuter and official use. In both cases, the balance is park visitor use. Houchins Ferry carried 11,647 vehicle crossings in 1970, whereas Mammoth Cave Ferry carried 42,829 during the same period or about 3.6 times more vehicles. Northbound traffic is from five to ten percent heavier than southbound traffic, because visitors who originate at Historic Entrance choose a different route back to their destination.

Mammoth Cave Ferry Road, 5.7 miles long, and Houchins Ferry Road, 6.7 miles long, across the park, provide access to the Hilly Country and a windshield experience for those who drive over them. These public roads are mostly one-lane wide. Their gravel surface is dusty in dry weather and roadside vegetation is heavily coated. Cars following closely move in a choking cloud of dust which is unpleasant; visibility is reduced and driving is hazardous. However, the 1.2 miles of Mammoth Cave Ferry Road from the Ridge to the River is two lanes wide and has been paved.

3. Recreational Resources

Noteworthy for boaters along the Green are fine riverscapes at Turnhole Bend, mouth of the Nolin, and Nappers Rollover. On the Nolin, the scenery is spectacular in the vicinity of Cubby Cove Hollow and Whistle Mountain.

Boating is the major use of the River Valleys. Hand-propelled boats and outboard motorboats up to 10 horsepower are used by sightseers and fishermen. Murky water and submerged snags discourage swimming and use of larger boats is hazardous. River banks are steep and muddy and are subject to annual flooding, so there are no beaches. At Mammoth Cave and Houchins Ferries, boats are launched from trailers by using the ferry boat ramps. It has been estimated that about 3,000 people, about equally divided between fishing and sightseeing, use their own boats on the rivers during the course of the year. During 1972, about 300 persons used river island campsites.

Many more, about 85,000 in 1970, take passage on the *Miss Green River* sightseeing boat during its season from April to November. There are a maximum of eight trips per day. For the entire season there were 1,065 trips and 85,641 passengers were carried. During August 1970 alone, there were 244 trips. Each trip is one hour in length to and from the vicinity of Sand Cave Island. Passengers hear a recorded message or personal narration, while underway, which is descriptive of the natural features of the river valleys and the park in general. Tickets for the one-hour *Miss Green River* trip are sold in the visitor center at Historic Entrance. The fees charged were as follows:

Time of Day	Adults	Children Under 12
Daytime	\$1.25	\$.60
Evening	\$1.35	\$.65

On the south bank of the Green at Mammoth Cave Ferry is a 60 car parking lot for *Miss Green River* patrons. Nearby is the sightseeing boat dock and the ferry itself. A two-lane paved road, 1.2 miles in length, connects the park road on Mammoth Cave Ridge with the ferry. A foot trail, part of a 6-mile

network on the river bluffs, connects the parking lot and the Historic Entrance to Mammoth Cave.

At the site of Dennison Ferry, near the east park boundary, a single lane gravel road, 1.6 miles long, extends to the south bank of the Green River from Cox Store Road. The park road becomes impassable during heavy rains. On the floodplain is a turnaround and people with small self-contained recreation vehicles sometimes spend the night here. There is no piped drinking water or sanitary facilities. Hand-propelled boats may be launched by sliding them down the steep, slippery, muddy, river bank.

Dennison Ferry is adjacent to the 9-mile free-flowing segment of the Green, which has many of the qualities of a "wild river." Here we believe many visitors will enjoy solitude, peace, and quiet, as they travel on the river in hand-propelled boats to enjoy sightseeing, nature study, and fishing. This is to be a "low key" use for relatively few people.

Tree-shaded Houchins Ferry picnic area is reached by single-lane gravel road from Ky 70 near Brownsville. There are six to eight picnic tables, a drinking fountain, pit toilets, and parking for a half dozen cars. This development is all on the floodplain on the south side of Green River.

There is no vehicular access to the Nolin in the park, but a secondary county road comes near it at Kyrock.

C. HILLY COUNTRY

1. Natural Resources

About 40 percent of the park's area is characterized as Hilly Country. Exploration is difficult because of lack of trails and dense undergrowth. However, on relatively steep slopes, where the hardwood forest is more mature, there is a thinner understory and walking is less inhibited. In such places, the forest floor is carpeted with wildflowers in spring. The forests are ablaze with color in the autumn. Generally, the Hilly Country is a rugged region of hills, flat-topped ridges, and deep hollows. It contains scenic viewpoints, picturesque rock outcrops, springs, streams, and waterfalls, and is well-populated with wildlife.

The Hilly Country harbors an over-population of Virginia white-tailed deer because browse is plentiful in the revegetating forest. The deer are thought to be responsible for the presence of such large numbers of ticks that they have become pestiferous to man and beast alike, except in fall and winter. Deer are live-trapped by Commonwealth employees and released on public lands elsewhere in Kentucky and there is heavy hunting pressure on adjacent private lands.

Watersheds, self-contained within the park and which are 150 feet or more in depth, have been identified in the master plan as "basin ecosystems." These are rather rare and their study would be valuable to the International Biological Program. According to the master plan, they are to be studied by competent scientists and those selected are to be untouched by any development. These will remain as scientific reserves. One of these, the north branch of Wilson Cave Hollow, adjoins Big Woods, a tract of about 300 acres, which is reported to be one of the best remaining examples of a white oak-black oak-tuliptree forest (upper slopes) and beech-maple forest (lower slopes) in eastern North America. It has probably never been logged, but windfalls have been removed.

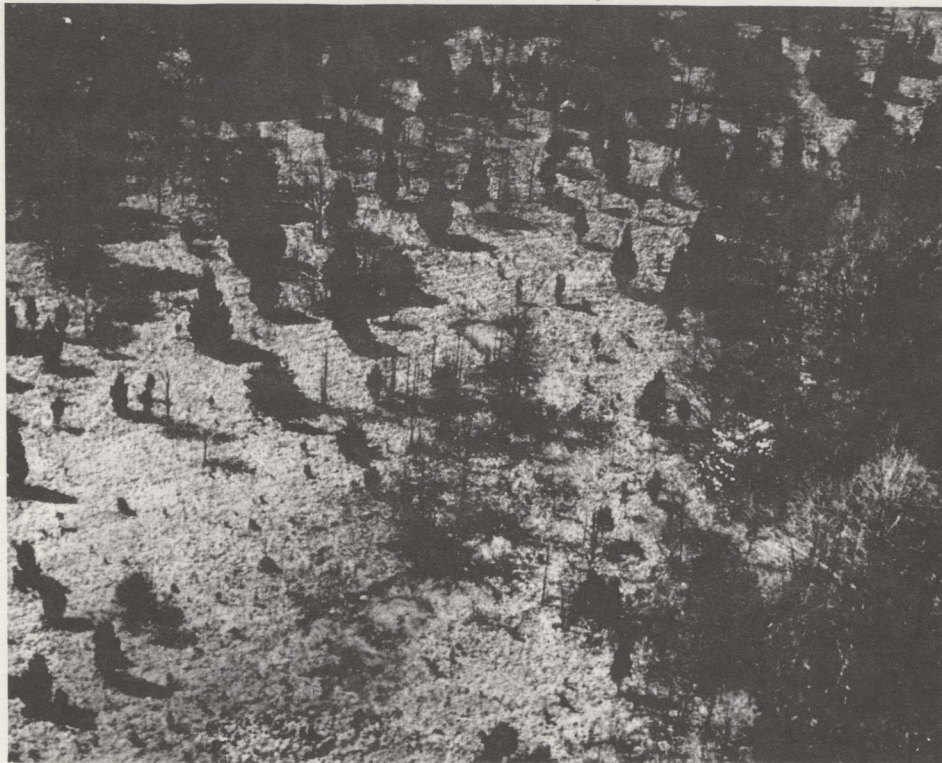
At the head of the Wet Prong of Buffalo Creek are Big, Blue, Boiling and other large springs. They feed this attractive perennial stream and it sinks underground for a short distance before reaching Green River.

No cave systems of any extent are known in the Hilly Country because the cave-bearing limestones dip to the north, away from the Green River. Moreover, the river intercepted drainage in the past, as it does today, from the Sinkhole Plain to the south. Thus, ground water has not flowed horizontally to carry away dissolved carbonates and create lengthy cave passages.

Unfortunately, the Hilly Country does not possess many prominences, having been dissected from a plateau, and this coupled with the dense vegetation, makes for few distant views especially during the growing season. Much more can be seen when the trees are not in leaf. However, from the top of Whistle Mountain, reached only on foot, there is a spectacular view of the narrowest part of the Nolin River Valley. With little vista clearing, there could be a good view of First Creek Lake from a rock outcrop about 0.25 mile northwest of Temple Hill Cemetery. The strategic location of Goblin Knob suggests the possibility of a view of the Green River alongside Nappers Rollover, when the forest matures at the top of the Knob, though some vista clearing may be necessary.

From the Brooks Knob, First Creek, Hickory Cabin and Flint Ridge fire lookout towers, the Hilly Country looks deceptively smooth with a series of undulating ridges and shallow valleys. Such is not the case when one travels cross-country on foot. Then the rugged topography becomes apparent.

The regenerating forest, especially in abandoned fields, has caused a great increase in the deer population. There is much sign of overbrowsing. It is estimated that there is a static population of 2,400 Virginia white-tailed deer in the park. By Kentucky statute, control of the fish and wildlife is vested in



Cedar karren in Woolsey Valley on the Mammoth Cave Plateau.



Flood debris deposited at upstream end of island in the Green River.

the United States. Public hunting is prohibited in national parks, but a live-trapping program has been carried on for 13 years by cooperative agreement with the Commonwealth. During 1970, 142 animals were trapped and 124 of these were released on public hunting lands throughout Kentucky; 18 fatalities occurred among the captured animals. The buck-doe ratio was 1:1.3. The largest deer trapped weighed 225 pounds and the smallest was 27 pounds. Hunting pressure on private lands surrounding the park is heavy and poaching does occur on park lands.

2. Cultural Resources

It is possible that more thorough field work may locate additional Indian sites and artifacts.

Good Spring Church and several cemeteries are located in the Hilly Country and evidences of old fields, homesites, and road traces may still be observed. The demarkation between old fields and more mature woodland is clearly apparent from an airplane.

A ranger station (residence and garage) is located at Maple Springs. These buildings were built as Civilian Conservation Corps projects. The ranger patrols the rivers and the land north of the Green. Adjoining the ranger station is the Deer Reproduction Control Laboratory, which houses a joint study of the Bureau of Sport Fisheries and Wildlife and the National Park Service. Near the laboratory are pens where deer are kept for observation. Captive animals from the wild herd are used for experimental purposes, but results are not yet conclusive. People are not encouraged to visit the laboratory and pens because quarters are cramped and the deer become restless in the presence of strangers and may injure themselves. When the study is discontinued, the pens and related structures will be dismantled.

3. Recreational Resources

About 100 horseback riders used unsurfaced management roads (former wagon roads) in the vicinity of Maple Springs during 1970. These and other management roads are available for hikers and equestrians. There is no estimate of the numbers of hikers, but it is reported to be so small as to be insignificant. Fishermen have established a path of sorts between Temple Hill Cemetery and First Creek Lake. Other than these, there is practically no off-road use of the Hilly Country.

D. PROBABLE FUTURE ENVIRONMENT WITHOUT THE PROPOSAL

Assuming relaxation of the current energy crisis and the imposition of no other constraints, summer vacationing and holiday weekend travel to the park by private vehicle will resume and continue to increase. This will cause continued overflow parking at Historic Entrance, overcrowding of the visitor center,

overloading of cave trips, denial to some of the privilege of taking a cave trip at the time of their choice, less diversity of cave trips; increase in visitor complaints, vandalism and littering; larger expenditures for maintenance; build-up of human waste and air pollution over Mammoth Cave; overuse of spring water resulting in probable loss of cave animals and retardation of geologic processes; greater income to concessioner from sales and meals, but loss from lodgings; larger expenditure of energy for propulsion of private vehicles; no restoration of natural conditions through removal of developments over the Mammoth-Flint Ridge Cave; and no development of trails and primitive campsites for greater use of surface features.

Private enterprise outside the park will probably continue to expand lodgings, camping, and tourist services to meet increasing visitation. Since Mammoth Cave is the foremost tourist attraction in Kentucky, it is important that the National Park Service welcome visitors and provide them with a high quality experience while in the park.

A ranger station (residence and garage) is located at Maple Springs. These buildings were built as Civilian Conservation Corps projects. The ranger patrols the river and the land north of the Green. Adjoining the ranger station is the Deer Reproduction Control Laboratory, which houses a joint study of the Bureau of Sport Fisheries and Wildlife and the National Park Service. Near the laboratory are pens where deer are kept for observation. Captive animals from the wild herd are used for experimental purposes, but results are not yet conclusive. People are not encouraged to visit the laboratory and pens because quarters are cramped and the deer become restless in the presence of strangers and may injure themselves. When the study is discontinued, the pens and related structures will be dismantled.

About 100 horseback riders used unsurfaced management roads (former wagon roads) in the vicinity of Maple Springs during 1970. These and other management roads are available for hikers and equestrians. There is no estimate of the numbers of hikers, but it is reported to be so small as to be insignificant. Fishermen have established a path of sorts between Temple Hill Cemetery and First Creek Lake. Other than these, there is practically no off-road use of the Hilly Country.

D. PROBABLE FUTURE ENVIRONMENT WITHOUT THE PROPOSAL
Assuming relaxation of the current energy crisis and the imposition of no other constraints, summer vacationing and holiday weekend travel to the park by private vehicle will resume and continue to increase. This will cause continued overflow parking at Historic Entrance, overcrowding of the visitor center,

III. ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

A. MAMMOTH CAVE PLATEAU

(see Section I, Part A and Section II, Part A)

The draft master plan calls for six interrelated actions, over a 10-20 year period, to provide a higher quality park experience for more visitors while giving greater protection to the natural resources.

1. Expand Cave Trips

Expanding cave trips to accommodate the visitation expected during the next 30 years, involves a new tunnel, new elevator entry, lighting passages (now dark) and improving the trails therein, and reopening the front part of Great Onyx Cave. These measures are not expected to cause damage of a magnitude greater than what has occurred in the past (see box on p. 104). Additional guides will be needed. More electricity will be consumed, and more visitors will see Mammoth Cave.

Preliminary reconnaissance suggests that a tunnel entry similar to those at Carmichael and New Discovery Entrances might be constructed to replace New Entrance. This tunnel (angled shaft) could be bored through strong solid rock nearby and would be about 600 feet long. It would contain a series of ramps and steps for easy walking. No damage to the cave is known to have occurred when the two tunnel entries mentioned above were bored and they have been stable since their construction.

Converting Frozen Niagara from guided to semi-self-guided requires installing illuminated signs to provide information/interpretation, leaving cave lights turned on for the entire period, blocking side passages to prevent visitors from straying off the trail, and stationing guides along the route to provide interpretive services, and assist visitors in case of accident, illness, or electric outages. First aid kits and gasoline lanterns are cached at locations known to the guides, who also protect the cave from vandalism.

Increasing numbers of visitors, lengthening the period of illumination, and opening an entry to replace New Entrance, is not expected to have unacceptable deleterious effect on this part of the cave. Nevertheless, carbon dioxide levels will be monitored, and acts of vandalism may occur.

Unlike most passages in Mammoth Cave, the Frozen Niagara section is wet. Supply of ground water to the flowstone formations is not likely to be altered in any way by the new tunnel entry or by modification of the surface roadway, if required. It is presumed that Rural Electrification Administration (REA) will be able to supply the additional electricity for

lighting this section of passageway for a longer period. Some wattage could be saved and heat reduced by substituting fluorescent for incandescent fixtures, where feasible. It will be no problem to extend electric lighting into the new tunnel entry at Frozen Niagara from existing wiring, but how much more wiring and wattage will be required is subject to further study (see I.A.1.c., Phase I).

In the second phase, the Violet City tour route, now seen only by parties carrying hand lanterns, will be lighted with electricity and become semi-self-guided. Visitors will enter, as now, through the Violet City Entrance and exit by a proposed elevator from Star Chamber. Only two guides are used now for the lantern tour, with 40 people maximum per trip. Additional guides would be needed for the new (Phase II) service. Much of the Violet City route traverses passages of large dimension, some more than 40 feet in height and width. Admitting more people is not expected to have adverse effect on the cave's features or values, except that there will be some vandalism.

Extension of lighting with its cables, transformers and fixtures will have visual impact, as will the elevator entry, though much of this can be hidden. Again, it is anticipated that the additional electricity for lighting and elevator operation will be available through Kentucky Utilities Company, which serves this part of the cave.

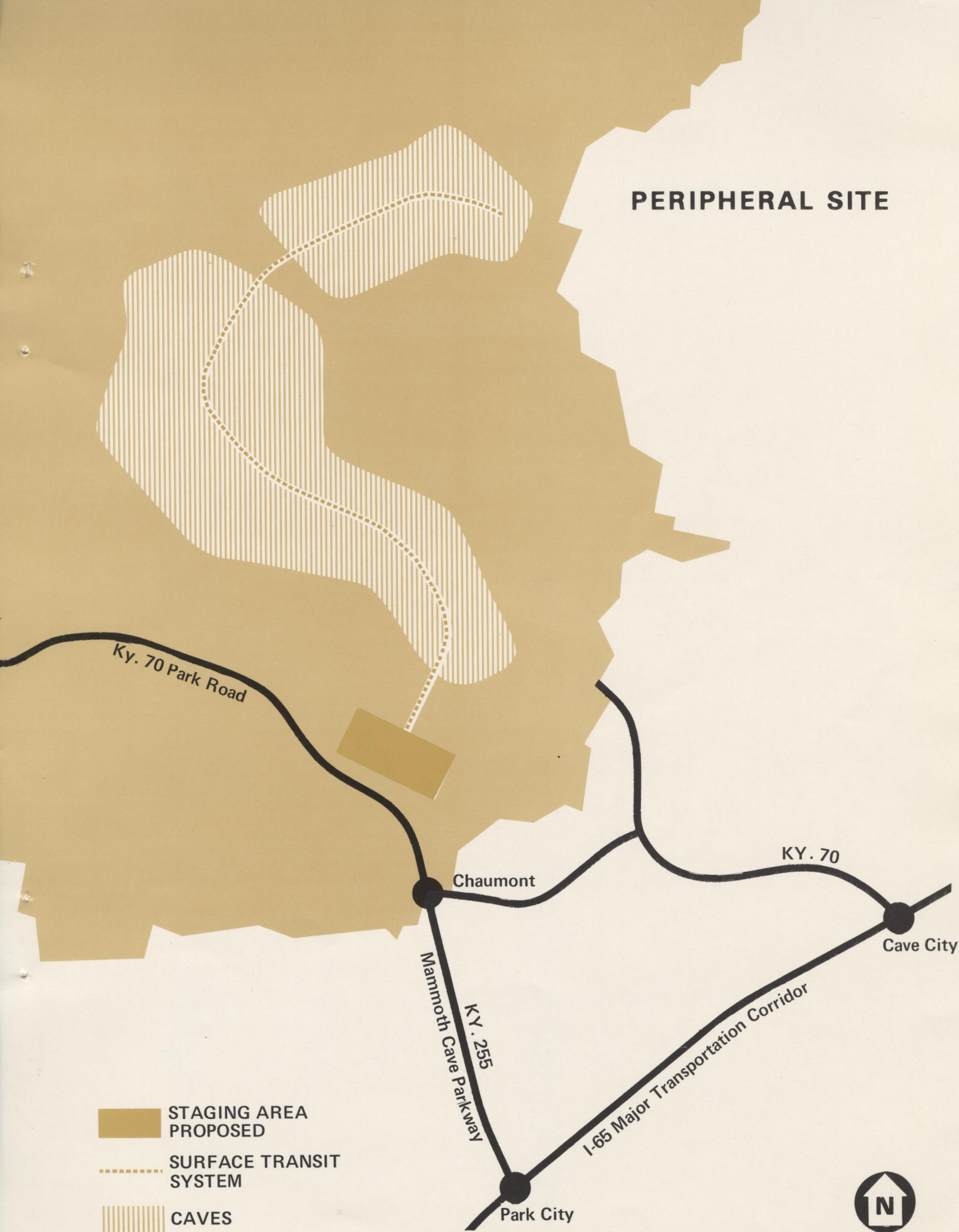
The Violet City section to be lighted is about 6,800 feet long. Electric service is now within 400 feet of Star Chamber, where the elevators will be installed, and practically adjacent to the Violet City portal. No engineering studies have been made yet on these electric power requirements.

To replace the Violet City lantern tour, the front part of Great Onyx Cave, will be reopened to groups of 25 to 40 per trip. Two guides would accompany each party, and hand lanterns will be carried. Great Onyx is a small cave and was shown to parties of this size when it was operated commercially.

2. Relocate Staging Area to Peripheral Site

Development of the peripheral staging area and widening of a short segment of Ky 70 will result in slight loss of habitats; destruction of vegetation; require extension of water, sewer, and electric lines; and there will be a large concentration of people and vehicles. On the other hand, some park land must be devoted to intensive public use and for management purposes. Losses of habitats and vegetation types are minimal since both are common in the park. Over a period of time, many more people will be accommodated efficiently, and in pleasing surroundings with a parking lot and transit terminal designed for the purpose.

PERIPHERAL SITE



When a detailed site plan is prepared, following approval of the master plan, parking lot designers will consider the following points to lessen its environmental impact: direct runoff into existing channels; reduce runoff by providing dry wells and tree islands throughout the lot; use sediment traps in runoff channels during construction. When the lot is completed, install permanent dual lagoons in runoff channels from which floatable solids and petroleum products can be skimmed and suspended solids settled, before the water goes underground. Such precautions as these are essential in maintaining a flow of unpolluted water into the caves. Otherwise, silt could plug the underground channels and contaminants could affect adversely the blindfish and other troglobites in the subterranean streams. Surface water enters such streams through sinkholes and fissures located generally along the perimeter of the ridges at the edge of the sandstone cap. The passages directly beneath the parking lot are dry. Parking lot construction will not affect these for they are beneath the sandstone cap, which is both impervious and structurally sound.

The terminal building planned for this site has not been designed either, so its impact cannot be assessed at this time, so far as size and materials are concerned. Suffice it to say that telephone lines now pass the site and electric service by REA is at Chaumont, about a mile away. Water supply and sewage disposal, however, require special consideration.

It is expected that up to 130,000 gallons of water per day would be required to service the site by the year 2000. It could be purchased from a water district in an adjoining county, or the Green River could be tapped in the park with the National Park Service establishing and operating its own treatment facilities. Of these alternatives, purchasing water is favored at this time. The present water distribution system could be connected to the Union City site by a pipeline across Doyel Valley from the Mt. McKinley well and storage tanks on Mammoth Cave Ridge 1.5 miles distant. If the pipeline should cross an unstable area at the bottom of Doyel Valley, special care will have to be taken in its construction (see I.A.6., III.A.6., etc.).

Sanitary sewage from the staging area could be piped about 3.8 miles across Doyel Valley and along Mammoth Cave Ridge to the existing system at park headquarters and treated at the plant on the Green River near Mammoth Cave Ferry. Sewage from the comfort stations in the cave at Mt. McKinley and Snowball could be picked up en route. Crossing Doyel Valley will require pumping and an automatic check valve will be placed in the pipeline to shut off the pump in case of line failure. If tertiary treatment at the staging area proves practical, then only the effluent need be piped across Doyel Valley, but it would be less costly to operate the one plant near the

Green River. If, necessary, this plant can be expanded to handle the load. Its present capacity is 120,000 gallons per day.

To serve the staging area, 3/4 mile of Ky 70 between Chaumont and Union City will be upgraded from two lanes to four lanes. While most of the ridge top is forested, the trees are small. Cave passages are not known, but may exist. Again, sediment traps will prevent soil pollution of underground streams during construction, and runoff from the completed roadways will be directed into existing stream channels as at present. Ultimately, an overpass will be required to carry exiting traffic from the parking lot onto Ky 70. This will have some visual impact.

It is possible that at some time in the future enough people will be spending the night at towns nearby or will be coming by railroad excursion trains, to warrant establishing a transit shuttle service to and from the staging area. This could reduce considerably the ultimate size of the parking lot.

3. Extend Transit System

When the first stage of the parking lot at Union City is operating, the present fleet of buses will be expanded to transport passengers in cars stored there about 5.5 miles to the staging area at Historic Entrance. The master plan suggests that the concessioner continue to operate the expanded transit system. As new cave entries are opened the transit system will be extended to serve them. In time, visitor use will build up to the point where transit is on a continual shuttle system. This will reduce waiting time materially at the terminal building and at the various cave entries.

Compared with personal cars, the transit system will reduce atmospheric and water pollution, and consumption of fuel for propulsion to a great extent, and it is anticipated that visitors will be able to relax and enjoy their park experience more. Volume of litter along roadways will be reduced also.

It is planned that a recorded message will be presented on transit vehicles to acquaint visitors with the features of the park so that their visit becomes more meaningful.

4. Phase Out Existing Facilities

In this order of priority, the following facilities will be phased out:

- Great Onyx Civilian Conservation Center (see drawing on p. 15)
- Historic Entrance Area (see drawing on p. 11)
- Government and Concession "Housekeeping" Areas (see drawing on p. 13)

Impacts common to the discontinuance of all three facilities include the dismantling of all the buildings and structures with some unrecoverable

economic loss of construction materials; restoration of the areas disturbed by development to their natural appearance; removal of the threat of pollution or damage to underlying caves by spills of sewage, fossil fuels, and surface runoff; water will be available for other park uses and more of the flow will be restored to the caves; consumption of electric energy and fossil fuels will be reduced and some of the former could be made available for lighting cave passages and operating elevators when public tours are expanded; social trauma occasioned by changes in long-established activities and functions; greater probability of perpetuating park resources without deleterious effects; higher quality of park experience for the benefit of visitors.

a. **Great Onyx Civilian Conservation Center** — Since June 1965, this 214-man center's program of construction projects has resulted in teaching manual skills to several hundred corpsmen and has made them self-sustaining economically. The community and the park have benefitted from these projects. The community has also received benefits from payroll expenditures and from local purchases of supplies and materials.

b. **Historic Entrance Area** — Over the years, some tourist facilities and services now performed at Historic Entrance may be needed no longer. Those employed therein who lose their jobs and who desire to continue to work in that field should find ready employment in the expanding tourist industry in the region. Much of this expansion is occurring within a 10-mile radius of the park.

Upon fulfillment of the master plan, the traditional uses at Historic Entrance will terminate, including overnight accommodations, dining in the hotel, camping, and picnicking, because private vehicle access will be cut off in favor of the transit system. These modifications in use are all part of the effort to relieve congestion in the vicinity of the park's prime feature.

Once the peripheral parking area is in use, it will no longer be necessary to commit rangers' time and energy to parking cars at Historic Entrance, and to towing them out when they become mired in the mud following a rain storm while their occupants are on a cave trip.

When the Union City development is completed, park operations will be streamlined to the needs of the day-use visitor. Congestion will have been removed from Historic Entrance and visitor concentration located in an area of lesser value.

The visitor center is cooled in summer by air pumped from Mammoth Cave. A shaft was drilled for this purpose and a large electric fan was installed at its base. This practice, however, has had no known deleterious effect, though the noise of the fan can be heard by cave visitors passing by on their way in and out of the Historic Entrance. Another cooling system will be installed in the transit terminal when the present visitor center is razed and relocated at the peripheral staging area.

Removal of buildings and structures from the Historic Entrance area, including the picnic area and campground, will improve the environment by removing great volumes of vehicle exhaust and heating plant emissions. The congestion of hundreds of cars and thousands of people will be relieved. Quantities of polluted parking lot water pouring into Historic Entrance and Mammoth Dome, will disappear along with the unsightly array of a conglomeration of buildings and structures.

About a half mile distant from Historic Entrance and out-of-sight in what is now the campground, the upper landing for the Star Chamber elevator and a transit loading dock will be located. This will be a minor visual intrusion in the immediate vicinity.

c. Government and Concession "Housekeeping" Areas — The master plan is silent about a relocation site for National Park Service administrative offices, corporate offices of National Park Concessions, Inc., living quarters for park and concessioner employees, park and concessioner warehouses, and the park utility area all located on Mammoth Cave Ridge. Many of these activities are housed about a mile east of Historic Entrance and out-of-sight of the public. Some are essential to the administration, management, and operation of the park. Staff will have to be available to meet emergencies and accomplish maintenance, and these activities require support facilities. Their future location is best dictated by experience after operation of the peripheral staging area has begun. The thrust of the master plan is to remove all but the activities essential to visitor use from the karstic (southeast) part of the park, thus relieving their impact on these highly significant and fragile resources. Most functions could be located in or near a town close by. If this happens, park personnel would become more involved in community affairs.

5. Modify Intrapark Circulation

Key to fulfillment of the master plan is closing about half the mileage of public roads on Mammoth Cave Plateau to travel in personal cars so that these roads may be used exclusively by transit vehicles. At the appropriate

time, the National Park Service will petition the court to amend the road deed. When these roads are closed, some motorists will be inconvenienced by being unable to use them for motor sightseeing. However, these people will be able to do so by riding over them in a transit vehicle free from traffic congestion. Similarly, public conveyances will be able to maintain their schedules without interference from other vehicles.

Private vehicle access to churches and cemeteries will be maintained.

Using existing paved roadways on Mammoth Cave and Flint Ridges for the transit roadbed will avoid clearing away more forest. Most of the old wagon road across Doyel Valley can be rebuilt and used between the staging area and Mammoth Cave Ridge. Runoff from its paved surface will enter the cave system. Although there is some savanna vegetation in Doyel Valley, typical of the species which grew on The Barrens of the Pennyroyal Plateau in pre-Columbian times, this crossing is not expected to have adverse effects on this plant community. Savanna vegetation grows in other solution valleys in the park.

6. Utilize New Source of Domestic Water

Since the master plan advocates purchase of water from an outside source, its impacts will be addressed here.

Installing a water main along an approach road to the park will encourage shoe-string, commercial development oriented to such tourist services as meals, lodgings, curio sales, automotive supplies and fuel, amusements, and the like. Done tastefully, and with a high level of customer service, this could be an asset to the park and region.

If development proceeds along Ky 70 with the extension of a water main from Cave City to the park, this road could become congested and result in traffic problems unless the road is widened. Right-of-way would have to be obtained in advance of development else property values could become prohibitive. There is no governmental body empowered to control development. A "neon strip" approach detracts somewhat from the anticipation of a national park visit.

Only the Mammoth Cave Parkway would retain a rural environment provided the present policy of the Kentucky Department of Highways prevails, i.e., allowing only the three accesses now designated.

Sewage and surface runoff from such developments could enter the underground streams in the caves and be detrimental to them and to public health. If Park City should establish a sewer district, sewage from the staging

area at Union City might be discharged into it instead of being piped across Doyel Valley. As more water and sewage customers tap into a main, the probability is greater that a lower rate will prevail for all.

In Retrospect

It must be borne in mind that Mammoth Cave and Mammoth Cave Ridge — and the entire Mammoth Cave Plateau — have been subject to major environmental impacts from the beginning of the 19th century. The land was cleared for farming and grazing, wildlife was slaughtered (bison and passenger pigeon), wildfire was rampant, forests were logged repeatedly and timber was used locally and exported. Hotels were built and some local farmers raised foodstuffs to supply the tables. They built wagon roads and some of these have been rebuilt and are the basis of today's circulation system in the park. Exploitation of Mammoth Cave, itself, began in 1809 with saltpeter mining and continued with exploration of passages and the building of trails, stairways, and bridges to accommodate millions of visitors on guided tours. Smoke from thousands of torches blackened walls and ceilings. While electric lighting is cleaner, its miles of wires, massive transformers, and fixtures attached to walls have had their impacts, both physical and visual. Lowermost passages were flooded in 1907 when dam and lock 6 were constructed on the Green River near Brownsville. New tunnel and elevator entries, paved trails, steel and aluminum stairways and bridges, comfort stations, and a dining room have all been constructed in Mammoth Cave. Much of this work has required blasting. The marks of these alterations are an irretrievable commitment of resources. Yet only about 10 miles of the 45 miles* of known passages have been shown to the public and, of these, only about 6 miles are being used now. Admittedly, some passages are too constricted for tour groups; other passages undoubtedly await discovery.

In spite of this long history of use and manipulation by man, visitors to Mammoth Cave Ridge and to Mammoth Cave continue to be enthralled and inspired, and scientists continue to make new discoveries, including "virgin" cave passages.

* Discoveries in 1972 near Frozen Niagara and Echo River have raised this total to 53 miles.

B. RIVER VALLEYS

(see Section I, Part B, and Section II, Part B)

7. Provide Additional Sites for Picnicking and Primitive Camping

Houchins Ferry, south and north banks, is to be the only point of access to the river valleys for motorboating. The scenery, the geology, the wildlife, and the fishing on the Green and the Nolin are good. Use of some additional floodplain is a modest investment of resources for compatible public use, though it will add some pollution, destroy some habitat, create more noise, and add to the responsibility of the protective (ranger) force.

On both banks of the Green River at Houchins Ferry, enough space is available to expand picnicking and parking by clearing away undergrowth. Grass covers the ground in the present area, and this would be planted in the expanded area to form a stable footing because the alluvium is very slippery when wet. On the north side water is available from a spring nearby.

At the site of Dennison Ferry, no impacts of consequence are anticipated by providing better maintenance of the gravel approach road, installing more drainage structures, and adding some rock for a stable subgrade at the primitive campsite itself. Here some clearing of undergrowth is needed, sanitary toilets are to be installed, and water may be provided either from a spring or well, if tests prove satisfactory.

The river bank is steep and slippery; therefore, it is proposed that a plank with cleats or wooden steps be provided to facilitate launching and retrieving of canoes, john-boats, and other hand-propelled craft.

The higher river islands, to be selected (see footnote on page 26), will be designated for primitive camping. A small site will be cleared on each island and provided with sanitation, when warranted, and a fire circle, but potable drinking water will not be furnished. Even though river water is generally safe for drinking, boaters will be advised to carry their own drinking water or to treat the river water themselves. Even the higher islands are flooded periodically so campsites should not have any serious effects on the environment.

On the Nolin, a primitive campsite will be located at First Creek Lake, for there are no islands to use. This site will be accessible to hikers, also, and if warranted a shelter could be provided there. (See discussion under item III.C.10.).

Even though about 3,000 boaters are estimated to launch their boats in the rivers each year, most of these people are fishermen and sightseers. Hardly

anyone now takes a boat trip that requires an overnight stop. The potential for such use exists and the master plan encourages it. During 1972, about 300 persons used river island campsites. Again, the cumulative effect on the resources by these uses appears to be minimal.

C. HILLY COUNTRY

(See Section I, Part C, and Section II, Part C)

8. Build Transpark Road and Bridge

When Mammoth Cave Ferry is discontinued and the transit system becomes fully operational, the transpark road corridor will be needed. The road will require the permanent clearing of a corridor through the regenerating forest for approximately 5 miles though only 2 miles will be on a new alignment. It will be a visual intrusion for river travelers, cause loss of habitat, modify drainage, create erosion during construction, and more animals will die from traffic accidents. Easier accessibility may result in more poaching.

The corridor selected, from the vicinity of Arthur to the vicinity of Ollie, seemed best topographically, both north and south of the river. It incorporated existing roads to a great extent, and much of it lies on the Caseyville Formation, which is a sandstone conglomerate that would be a good foundation for the roadway. No engineering, biological, or archeological studies have been made on-site, so problems unforeseen now may require use of another alignment. Indian rock shelters have been found in some of the hollows of the park, so an archeological reconnaissance will have to be made before the exact route is selected.

The Green River, at the tentative site of the bridge, is an impoundment with a pool elevation of 421 feet, and from the Geological Survey map, it appears to be about 225 feet in width. Presumably, the Corps of Engineers could advise as to maximum flood dimensions at this point, and that is likely to be less than the 50-foot crest predicted for sections of the river and valley which are narrower. Until borings are taken, foundation problems cannot be determined and that will dictate the type of structure to be built.

The bridge and road are to be designed for recreational traffic only, i.e., passenger cars and buses, and classified as a minor park road. Pavement width is to be 20 feet with 3-foot shoulders, and design speed of 35 miles per hour. It is to lay lightly on the land, hence the ridge top location, wherever possible, but there could be some heavy cuts and fills at the river crossing. In 1969, the bridge was estimated to cost about \$1.25 million with a span of 1,000 feet and the road about \$150,000 per mile.

Two or more trailhead parking areas for a half dozen cars and two buses each will be provided north of the river.

Local traffic will shift to the new road because of the closing of Mammoth Cave Ferry Road. Houchins Ferry may operate seasonally only, as a "living history" exhibit, according to the master plan. The gravel road north and south of the river will have a surface treatment to settle the dust because it will remain to serve riverside developments planned at Houchins Ferry (see Section I, Part B). This minor road will continue with a width of 12 feet and 2-foot shoulders.

Once the transpark road is finished, local people will find travel time shorter, less wear and tear on their vehicles, and a more relaxed and safer trip for the driver, compared with using either of the existing "ferry" roads.

Visitors will have access to trails and primitive campsites north of the river (see I.C.9. and 10.) and travel will increase to and from the recreational facilities on Nolin River Lake. This should result in personal savings in travel costs, and should stimulate development of new tourist services both north and south of the park, thus increasing the tax base. It may also encourage further sales of real property for vacation homesites near the lake.

Providing a more direct connection between Mammoth Cave National Park and Nolin River Lake, operated by the Corps of Engineers, will tie together two public areas offering diverse and high-quality, outdoor recreation opportunities. Together the areas could provide a vacation destination of appeal to a wide segment of the population. Camping and water-oriented recreation coupled with hiking over rugged terrain and cave visits could appeal to every member of the family. This kind of recreation could sustain interest for several days and generate repeat visits over a period of many years.

9. Establish Trail System

Trail construction and use will affect habitats, alter microclimates, increase poaching, produce litter, and vandalism will occur. There is a possibility that more forest fires will be started in remote places because of human carelessness. Horseback riding and hiking over park trails are compatible uses, but motorized vehicles are excluded by park regulations.

Studies of old topographic maps and personal experience of the park staff in following old farm wagon road traces suggest that these could be brushed out to form the basis of a primitive trail system. As on-site studies are made, there will be adjustments in alignment to provide a more scenic route or to include points of special interest. In so doing, however, care will be taken to preserve habitats and species, both plant and animal that may be rare or infrequent in occurrence, and to avoid sites of pre-Columbian Indian occupation or activity. The trails will be laid out so as to include

representative plant communities, geologic formations, streamsides, waterfalls, and scenic vistas. A loop system from trailheads along the transpark road will be designed to enable users to start and return to the same point without backtracking.

Because of the north-to-south drainage of the Green River tributaries there was little east-west travel in the park across the hollows. Instead, this was done along the ridge top north of the park where the State Highway System is located today. Necessarily, then, east-west travel will require much entirely new construction of the trail bed, and fords or bridges will be needed across streams. A crossing of Buffalo Creek will be avoided within a half mile of its mouth as it would be flooded out every spring. Similar circumstances exist at and near the mouths of the other tributary creeks. Cliffs, rimming many of the hollows, are another constriction on trail routing. Breaks in the continuity of the cliffs do exist, however, and a trail could be constructed there, though tight switchbacks might be required. Otherwise, no unusual problems are anticipated in trail building.

There will be two trailhead parking areas on the transpark road and one along the Houchins Ferry Road to provide access to the proposed trail system. A 24-hour ranger patrol will be necessary to protect hikers' cars in the trailhead parking areas.

Because of the ease of accessibility to the proposed trail system from parking lots along the transpark road, trail use will probably build up in 5 to 10 years to the point where the primitive trails will have to be widened and surfaced. These measures will help to prevent erosion and preserve the environment, but will be more of an aesthetic intrusion and more vegetation will be lost to trail construction. Need for surfacing will be hastened if there is much horseback use on these trails. Should the latter increase, it may be necessary to lay out a separate trail system for riders.

10. Develop Primitive Campsites

Additional public use of First Creek Lake and Maple Springs vicinity will affect the habitats through the clearing of vegetation, and simple structures will be introduced into the forest. Dead trees will be cut for firewood; there will be smoke from campfires; and danger of accidental forest fire starts will increase. Vandalism will occur and ranger patrols will have to become more frequent. Campsites will have to be cleaned up regularly and litter removed, and the sites themselves will be a visual intrusion. They may be relocated periodically if the use appears to be damaging and this will give the sites opportunity to revegetate.

Upon completion of the transpark road, trailhead parking areas, and trail system, the master plan foresaw trail use would increase to the point where

campsites will be needed. "Helter-skelter" camping is harder on the resource than development of primitive campsites consisting of a campfire circle, sanitation, and a simple shelter. The latter is needed to protect hikers from sudden summer downpours and to provide a dry place to spread out a sleeping bag in this region of heavy annual precipitation and high humidity.

The shelter might be of the Adirondack type built from yellow-poplar logs cut on-site and provided inside with bunks lined with hardware cloth for the sleeping surface. This kind of facility has been provided for hikers in many eastern national parks. Some may argue that shelters are unnecessary because light-weight tents are available at low cost. Pitching and ditching tents, in an area expected to receive heavy use, is likely to be much more harmful in compacting soil and in damaging roots and trunks of trees, than a permanent shelter would be.

Users of the campsite at First Creek Lake will have to carry in their water or treat lake or river water themselves because no other source is available. Initially one campsite will serve boaters and hikers. When demand rises, additional campsites can be located on or near the lakeshore. The lake is surrounded by a dense, deciduous floodplain forest. The campsites would be about a mile west of the Houchins Ferry Road at Temple Hill. An overnight stop at the lake would permit time for fishing in the lake or river while hiking the proposed 9-mile loop trail in the Nolin River and Buffalo Creek watersheds. Its isolation will tend to restrict installation of elaborate facilities.

Maple Springs primitive campsite would be about 4 miles east by trail from the proposed transpark road trailhead. Potable drinking water could be piped from a spring. Several simple shelters are to be built here to house school groups interested in environmental education, for this is an excellent place to demonstrate the interaction of man and his environment. Nearby are old homesites, overgrown fields, wagon road traces, Good Spring Church, cemeteries, and a ranger station. Public access to the church from the north park boundary is provided for in the road deed but the road is not to be upgraded. Several half-day and all-day hikes may be taken from here, also, when the proposed trails are built.

The transpark road, trails, and primitive campsites are expected to open a new dimension of outdoor recreation within Mammoth Cave National Park. This will attract a segment of the population to the park who have not visited it before.

D. LAND AND CAVE PASSAGE CLASSIFICATIONS

(See Section I, Part D, and Section II)

These are the outgrowth of the basic study of the ecologic, economic, and sociologic environment of the park and its region. Hence, the classification of land

and of cave passages was one of the first steps in the planning process. During planning, alternate uses were considered and alternate sites for developments were studied in light of the assigned classification category. Some uses were rejected as being incompatible with the ability of the resource to absorb their impacts. The alternatives considered and rejected are contained in Section VIII of this statement.

Since land and cave passage classifications are planning tools, upon which development is predicated, departure from any of the 10 master plan "actions" described above would require reconsideration of the use category assigned to the area affected. The impacts of each "action" upon the resources are described separately in Sections III through VII. Therefore, further analysis of land and cave passage classification, as a separate topic under Sections IV through VII, is irrelevant.

1. No Wilderness

The following impacts are inherent to the Service's proposal that park lands are not suited for wilderness designation at this time.

a. Even though park management has committed itself to managing Class IIIA and Class IVA lands so that they will be of wilderness calibre in the future (see I.D.1.b. and Land Classification Plan drawing on p. 33), pressure of use on Class IIIA lands may require widening and surfacing primitive trails, and providing a water supply, toilets, sewage system, and cabins at campsites. These, or any permanent improvements, are not compatible with wilderness.

b. Motorboating will continue, thus interfering with solitude.

c. Most park visitors view only world-renowned Mammoth Cave and are not aware of the backcountry. To fulfill the Service's objective of diversifying park use, compatible recreational opportunities for the backcountry are to be provided thus attracting a broader spectrum of users than wilderness classification would allow.

d. Wilderness designation, if "low key" use prevailed, would help to maintain the integrity of "basin ecosystem" research.

e. From 1967 onward, some local sentiment has strongly opposed any wilderness designation in the park, surface or underground, fearing that future development would not be responsive to changing use patterns as visitation increases. In their view, this would curtail economic growth of the region.

E. SUMMARY OF CUMULATIVE ENVIRONMENTAL IMPACTS OF THE MAJOR PROPOSALS ON SIGNIFICANT RESOURCES

1. Water Quality

The quality of water in the underground streams should improve through the elimination of the Great Onyx Civilian Conservation Center, two sewage treatment plants on Mammoth Cave Ridge, discontinuance of Historic Entrance development and government and concessioner "housekeeping" areas, and closing 10 miles of public roads. The latter will comprise, for the most part, the proposed transit system roadbed.

2. Water Supply

Removal of the Great Onyx Civilian Conservation Center will immediately return about 7.2 million gallons annually to the flora, fauna, and geological processes of the Flint Ridge Cave System dependent upon that water.

Once water is available from an outside water district (negotiations for funding are underway) to meet the park's total water needs, all the water flow from springs will be restored to the caves.

Private development of tourist-oriented businesses will string out along the water main proposed to serve the park. If the pipe is adjacent to Ky 70, traffic congestion could result if the road is not widened. The rural open land now characterizing this approach to the park will give way to "strip" development along the highway, thereby detracting somewhat from the anticipation of a national park visit. Disposal of additional sewage and contaminated surface runoff resulting from this expansion of commercial activity could pollute the underground streams in the park and that could be harmful to the cave fauna and might force closing of some cave passages used for tours if the condition became hazardous to public health.

3. Air Quality

Volume of exhaust emissions from any kind of transit system will be but a small fraction of that produced by the private vehicles now being driven to Historic Entrance.

Removal of developments from Mammoth Cave and Flint Ridges will eliminate pollution from oil-fired furnaces, as well as the hazard of accidental oil and gasoline spillage from tanker trucks and underground storage tanks.

4. Vegetation

At construction sites, vegetation will be cleared and some habitat destruction will result.

Site	Acreage	Vegetative Types
Peripheral Staging Area	30	Broomsedge-Eastern Redcedar
Doyel Valley Transit Crossing	5	Oak-Hickory; Broomsedge-Eastern Redcedar; Savanna
Cross Park Road and Bridge	10	Maple-Birch; Sycamore-Box-elder; Broomsedge-Eastern Redcedar; Oak-Hickory
Widening Ky 70	3	Broomsedge-Eastern Redcedar; Oak-Hickory
Ditches for Water Main and Sewer Line	5	Broomsedge-Eastern Redcedar; Oak-Hickory

5. Wildlife

Those animals, whose territory now encompasses construction sites, will be displaced. For most, this will be permanent. Included are nesting sites and foraging areas for passerine birds and small mammals over a total of 53 acres. Their population on affected areas is not known.

Gross number of road kills will probably be fewer because of a net reduction in road mileage. At Mammoth Cave, deer, squirrels, turtles and snakes suffer most from vehicular contact.

Reopening cave passages, lighting them, and improving the trails therein will effect the troglobites (mostly invertebrates) by a reduction in their numbers, but this will be infinitesimal compared with the total population.

The six interrelated actions by which the problems of increasing cave visitation will be solved are designed to reduce the volume of polluted air and water entering the caves from in-park sources. Of broader concern, however, is the possibility that cave water sources may become polluted by agricultural pesticides, sewage, contaminated runoff, and the like. The master plan envisions considerable commercial development outside the park. Polluted water carried into the caves by an underground stream originating outside the park could cause widespread harm to the cave fauna along its course and even result in mass kills of certain species, like blindfish.

6. Cave Resources

As more of the cave passages are opened to public tours, there will be smaller parties and a wider choice of tours. Visitors will be able to see more of the

cave features and understand them better as interpretation improves. More guide positions will be required. There will be an increase of litter and vandalism. Once paved trails, concrete stairways, and metal railings are installed the installation is permanent, for all practical purposes. Lighting fixtures, electric cables, and transformers are essential, but are a visual intrusion where they cannot be hidden. Lights will remain burning in the Frozen Niagara section for longer periods than presently when this section becomes semi-self-guiding, but the drying effect of lights on the dripstone formations is not known at this time.

Minor trail improvements will be required for public safety before the front parts of Colossal, Crystal, or Great Onyx Caves are reopened for lantern tours. These aesthetic intrusions cannot be avoided. These three caves underlie Flint Ridge wherein are about 90 miles of wild cave passages. Only about 3 miles were shown commercially before the park was established and these are to be reopened to lantern tours when warranted by increasing visitation.

7. Recreational Use

The master plan's provisions will relieve, until the year 2000, present constrictions on cave visits by providing adequate surface facilities and cave trip capacity to match.

Planning for the future was based upon present use patterns which show that 70 percent of park visits occur during June, July, and August, that the parking lot contains most cars between 10 a.m. and 5 p.m., that most visitors remain in the park 4 hours or less, and that the 1-2 hour cave trips are the most popular. By a straight line projection of travel which occurred during the 60's, average daily visitation of 13,265 and 2,320 vehicles are to be expected by the year 2000.

Visitation now is limited by space for storing visitors' cars at Historic Entrance. Expansion there is unacceptable environmentally, hence the selection of the peripheral site at Union City. Special precautions will be taken there in building the parking lot and related facilities to protect the cave systems. There will be loss of surface habitat. Capacity of facilities will be adequate to meet travel projections to the year 2000. Space is available for further expansion when warranted.

The facilities will be designed for the comfort and convenience of the visitor and be a fitting introduction to his national park visit. There will be some congestion at peak periods because it is uneconomical to build facilities which will be idle most of the time.

Cave trip capacity will be raised and variety of trips increased by offering more trips per day, by making more passage semi-self-guided, by lighting passages now dark, by providing new tunnel or elevator entries, and by adding more lantern trips. Mammoth Cave is scheduled to receive the bulk of the new improvements and of future visitation. This is with the assurance from competent cavers that these modifications and loadings will not result in unacceptable deleterious effects. Through the year 2000, only about 10 miles of the 53 miles of the cave will be developed and used for tours. For the most part, development consists of improving trails in passages shown previously and installation of lights. After the year 2000, cave capacity can be increased further by applying the same measures.

Besides the staging area, concentrations of people may occur at cave entrances, sightseeing boat dock, and trail heads. The numbers of people will not generally exceed the capacity of a transit vehicle (say 40-50 persons) or two. Their guide would be awaiting their arrival and the transit vehicle would be scheduled to meet them at the end of their tour. Waiting time should be minimal. At Historic Entrance, however, a shelter and comfort station will be provided because more trips enter and leave there, and some people will be hiking the trails on the river bluffs.

There are also places in the cave where people congestion could occur such as Snowball Dining Room, at points where trails intersect, and in passages common to more than one tour.

Avoiding congestion is largely a matter of logistics involving guides, schedules, routings, and vehicles. The Service has dealt with and solved these problems at Mammoth Cave for 30 years. Furthermore, such problems are similar to those faced by any large city transit system and the technology is available to solve them. Removing personal vehicles from Historic Entrance and from the transit roadbed will relieve present congestion and allow for the increasing visitation of the future.

When the ultimate transit system is selected, it will benefit from new technology in this field. Environmental considerations, efficiency of operation, and the ability of the system to handle anticipated loadings will all be considered. The present bus fleet will be expanded at the outset.

Construction of the transpark road will eliminate two ferries which are closed at times of high water and daily during the early morning hours, will relieve traffic back-ups at the ferries, will shorten travel distances over paved roads between Historic Entrance and Nolin River Lake by about 2 miles, will provide a scenic crossing of Green River, and access to new trail heads, and traverse about 5 miles of park woodland. The bridge will be a visual intrusion for those traveling on the river by boat.

In addition, the transpark road and bridge, new trails, primitive campsites, and more boating will encourage many thousands to use the backcountry comprising 55 percent of the park. Only a few hundred people a year have used the backcountry in the past. Deleterious effects will include minor loss of habitat, more noise, wood smoke from campfires, adding some pollution and litter, and multiplying the duties of park rangers in such areas as fighting wild fires, search and rescue, and policing for poachers and vandals.

Some congestion could occur in the future at Houchins and Dennison Ferries when boat use builds up. About 3,000 people boat on the rivers at the present time. Because of the constricted space available on the floodplain at these sites, expansion of parking space for cars and boat trailers is limited. If congestion should occur, it is expected to be limited to a few weekends during the year.

8. Scenic Values

Removal of modern structures and paving at Historic Entrance will allow this area to more nearly resemble its appearance at the time of the cave's discovery. It is anticipated that solid debris from razing structures will be disposed of in a landfill outside the park.

The River Valleys and Hilly Country will become better known as more people discover some of the finest riverscapes in Kentucky and see some of the waterfalls, streams, cliffs, woodlands, and the spring and fall floral displays. Primitive trails and campsites will be intrusions and some fragile objects may be destroyed, as public use increases.

9. Land and Cave Passage Classifications

Carrying out the provisions of the Land Classification Plan (p. 33), including no lands designated wilderness, will result in shifting some of the present uses of the park to less fragile areas and eliminating others. Through it management is alerted to the location of the park's fragile environments so that only those uses compatible with their perpetuation will be permitted. Thus surface areas and cave passages of paramount scientific value will never be developed for more intensive use.

"Low key" use of the backcountry by hikers, backpackers, and boatmen will continue. Their use will be channeled so natural forest regeneration and associated wildlife will be untrammelled on the bulk of these lands. No other uses of these lands have been proposed by the Service or by others. Nevertheless, some of the public sector will maintain that these uses will not continue without Congressional designation of the park's wildland as wilderness. Others feel that the Service has all the legislative authority it needs to perpetuate the wild character of these lands.

Since the master plan is a reflection of the Land and Cave Passage Classifications, support of one supports the other, and vice versa.

10. Visitor Services

When the karstic southeast part of the park shifts to day use, those employed by the major park concessioner to operate the lodgings, dining room, camper's store, and automotive service station (about 40 people in peak season), will lose their jobs and require them to make sociologic and economic adjustments. The picnic area and campground, operated by the Service, will be phased out also. Visitors will have to seek these services outside the park. This may inconvenience some who have patronized park facilities in the past.

11. Energy Consumption

More electricity will be needed for cave lighting and for elevator operation as visitation increases. Phasing out certain facilities, as called for in the master plan, will make this electricity available thus reducing demand on existing generating capacity for new services.

Transit from the peripheral staging area will use far less fuel than if the comparable number of people transport themselves in private vehicles.

The ultimate form of the transit system has not been determined. It could be surface, elevated, air cushion, or some other system. It will be the subject of a separate environmental study when the time comes. Among the considerations then could be extension of the transit system outside the park to pick up passengers, destined for the park, at their lodgings in nearby towns, and at the L & N Railroad Station.

At the outset, buses will be used to transport visitors from the peripheral parking area, which will be the first stage of development at Union City. From there it is 5.5 miles to Historic Entrance. At this transfer point, visitors will take buses, as presently, to cave entrances. The ultimate development, for year 2000 visitation, requires only one new cave entry, by elevator, and that will be in the present campground. There will be no campground there. Buses to caves on Flint Ridge and the sightseeing boat dock will use existing roads. Therefore, expansion of cave trips and extension of bus routes does not appear to cause any problems new to park management. During peak periods, buses may run constantly between transit stops to reduce waiting time for passengers.

12. Nearby Communities and Parks

Providing and funding the following functions, now located in the national park, will shift gradually to private industry and other government agencies.

a. **By the major park concessioner** — 154 lodging units, dining room with a serving capacity of over 500 persons per hour, camper's store, laundry and shower building, automotive service station, corporate offices, warehouses.

b. **By the Service** — 145-site public campground, 75-site picnic area, administrative offices, 17 residences and 12 apartment units for employees, and a utility area with storage building, warehouse, shops, and automotive service station.

It is expected that these services and normal growth as park visitation increases will result in considerable economic benefit to the region, especially if a high quality of plant and services is maintained, and if care is taken to prevent polluting the underground streams. Hidden River Cave in the town of Horse Cave, Kentucky has been closed to public tours for decades by sewage pollution and industrial waste dumped in a sinkhole.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

A. MAMMOTH CAVE PLATEAU

(See Section III, Part A)

1. Expand Cave Trips

The Service, according to the draft master plan, is to appoint a resident management scientist to develop and direct a research plan for the park. He may be assisted by a research board appointed by the Regional Director of the Southeast Region. To develop data on the effects of cave development and use, the master plan also calls for establishing monitoring stations in the caves to measure the effects of opening new entries, reopening passages, and increasing numbers of visitors. The stations are to include instruments for measuring air and water quality and temperature, air moisture content, and evaporation rate, heat input of visitors' activities and lighting, and associated information. Data will be collected and compared from used and unused passages. When analyzed, such information will help to guide management so that constrictions may be applied if deterioration is taking place beyond an acceptable point.

The measurement of air quality, mentioned above, is to detect any build-up of carbon dioxide from the presence of increasing numbers of visitors. This is not expected to occur much beyond existing levels because there is a considerable natural flow of air through the cave. In winter, dry outside air is drawn inward; in summer, air is expelled. Measurement of water quality is primarily to detect contamination levels in the underground streams, so that its origin may be traced. Expansion of cave trips and using more passages is not likely to affect water quality.

Replacement of New Entrance with a sloping shaft bored through solid rock will have a lesser effect on resources than the previous dome-pit entry with its sequence of ramps, stairways, and bridges. The new tunnel portal will be fitted with a stout gate and an airlock, if study determines the need. None of the other portal entries to Mammoth Cave have an airlock, but study of these will be undertaken to determine whether they should. Bats now use some, if not all, of these artificial entrances for access to roosting places within the cave.

The Violet City route is now developed with a trail built during the CCC period except for about a half mile which was never completed. Airlocks will be provided at the top and at the bottom of the elevator shaft to Star Chamber. This will prevent air from being pumped out of or into the cave as the elevator ascends or descends.

Installation of lighting will be planned carefully so as to "hide" wiring, transformers, fixtures, and switch boxes as much as possible. In new installations, the Service will benefit from past experience at Mammoth Cave and at several other caves in the System, and will seek the advice of consultants.

A survey of historical, archeological, and paleontological resources will be undertaken before construction. During construction, evidences will be watched for and any discoveries will be called to the attention of competent people for advice before work proceeds.

2. Relocate Staging Area to Peripheral Site

During construction of the parking lot, terminal building, and widening of Ky 70, siltation will be checked with sediment traps. Following construction the area will be landscaped with native species of trees and shrubs, probably obtained from a nursery, and slopes will be seeded with indigenous grasses which will provide a cover until natural vegetation can establish itself. Providing trees in the parking lot islands will make it more pleasant, visually, and the shade will make the area cooler for cars and people. Because of a concentrated peak of visitation in the early afternoon, a total accumulation of 2,320 cars is anticipated in the year 2000. Cave loadings warrant paving of 1,600 parking stalls; for the 700 additional vehicles, stabilized turf parking will be provided. Transpiration from the shade trees and turf, evaporation from the pavement, and percolation through the dry wells and turf will all reduce surface runoff from the parking lot.

Before runoff water is directed into existing surface stream channels for entry into the caves, it will be cleansed by processing through dual lagoons in the following manner as suggested by the Atlanta Regional Office of the Environmental Protection Agency. From the first lagoon, floatable solids and petroleum products will be skimmed off the water surface. The second lagoon will permit suspended solids to settle. Water overflowing from this lagoon will enter surface stream channels. This water, according to EPA, will be superior in quality to runoff from agricultural lands. Surplus clay from parking lot construction could be used in building the lagoons, both in lining the bottom and in forming the dikes.

A considerable quantity of basal aggregate will be needed for the parking lot, and aggregate will be needed for concrete structures of various kinds. This may be obtained from local limestone quarries outside the park. Its production and delivery to park projects could bolster the local economy. Similarly, concrete mix is manufactured locally.

A 3.8-mile extension of the sewer line from the campground at Historic Entrance to Union City has the advantage that sewage from two in-cave comfort stations — Snowball and Mt. McKinley — could be picked up en route. Both are now on septic systems. This part of the line would be gravity flow, but a force main would be required across Doyel Valley. The pumping station would be located adjacent to Union City and below it an automatic check valve would be installed in the pipe which would close if loss of pressure occurred. Care will need to be taken in crossing Doyel Valley because of soil slippage areas on the slopes and possibility of slumpage in the sinkhole area of the valley floor. Danger of pipe failure is remote if the line is designed properly including the use of heavy-duty pipe where foundation conditions warrant it. A natural gas pipeline and water mains across the Sinkhole Plain in similar topography have not experienced any unusual difficulties.

In time there could be enough tourists staying in nearby towns desiring to visit the park to warrant establishment of a transit system between the town and the staging area. This could reduce significantly the number of parking stalls to be built, there would be less congestion of automobiles, fewer accidents on approach roads, etc. Except for large families, per capita cost of transit would probably be less than operating a personal car; use of fuel for propulsion would be much less; and air pollution would be reduced.

So far as is known, there are no historical, archeological, or paleontological resources which would be destroyed or affected adversely by any of the action related to the development of the peripheral staging area. A site survey will be undertaken before construction, however, to salvage artifacts and retrieve data, should any be discovered.

3. Extend Transit System

A transit system using buses has operated effectively at Mammoth Cave for nearly three decades. Removing visitors' cars from existing transit routes will make the system operate more efficiently and will lessen impact on many resources. For example, a 50-passenger bus replaces 15 automobiles. In terms of highway capacity, one bus replaces two automobiles. Conversion to an all-transit system will reduce significantly, on Mammoth Cave Ridge, road maintenance costs, the volume of exhaust emissions, the quantity of polluted water entering the caves from road runoff, the volume of roadside litter, and the numbers of animals killed by auto. It will also reduce waiting time. Buses are now often caught in a backup of cars a half mile long unable to find parking space at Historic Entrance.*

* During 1972, rangers relieved this situation by directing visitors to park their cars in unmarked spaces on the grassed areas whenever backups began to form at the entrance to the paved parking lot.

If a fee for bus transportation is charged in the future on the new system that requires all visitors to ride transit vehicles to cave entrances, there are offsetting factors which are significant. Round trip distance from Union City to Historic Entrance is 11 miles by existing roads. Many automobiles would burn a gallon of gasoline in travelling this distance. However, if all operating costs are considered, these average about 12 cents per mile, or a total of \$1.32 per car, or about 38 cents per passenger. Bus passengers now pay 50 cents each. The future transit system fare would be comparable to the average per passenger cost of operating a personal car over this route.

Private financing of additional buses should not be difficult because of their long life and their high resale value. Transporting ever-increasing numbers of visitors should hold the fare structure low while covering operating and amortization costs.

Transit is the only device known for moving large numbers of people economically in terms of cash, natural resources, and energy for propulsion.

As for the right-of-way itself, existing road corridors are to be utilized to the fullest extent possible. Where sections are abandoned, they will revert to forest in time and will thus be retrieved.

To cross Doyel Valley at grade requires rebuilding part of the old wagon road (unused now except for occasional ranger patrols) between Union City and New Entrance Hotel, and making a new connection from it to the bus roadway on Mammoth Cave Ridge which serves New and Frozen Niagara Entrances. Doyel Valley rests on limestone. Limestone also forms the floor of the Sinkhole Plain, which is crossed by major highways, a railroad, and several pipelines. No unusual problems were encountered during their construction or in their maintenance. It is reasonable to expect a similar experience in crossing Doyel Valley. During construction, every precaution will be taken to minimize erosion and siltation. Adding more water to the cave systems in the form of surface runoff from the roadbed should not be detrimental. Oil drippings and other contaminants washed from this type of roadbed should be minimal compared with a given length of public road in the park.

Even though there may be some loss to the savanna vegetative community through the construction and presence of the roadbed and pipelines, across Doyel Valley, there are other such habitats in the park which will not be affected by any proposals of the master plan. Nonetheless, the bounds of the habitat will be determined beforehand and the roadbed routed to avoid it, if possible.

Aural and visual encroachment from transit vehicles, the roadbed, and the pipelines should be minimal.

4. Phase Out Existing Facilities

By this action, each of the three areas – Conservation Center, Historic Entrance, and “Housekeeping” Areas – will be enhanced environmentally and aesthetically. None were in pristine condition before the park was established because each site had been used by man, intermittently or constantly, for a century or more. There will be some salvage of materials from buildings and structures which are dismantled. Once the need for storage of gasoline and fuel oil is removed, the threat of permanent damage to the cave system from leakage or accidental spillage will be relieved.

- a. **Great Onyx Civilian Conservation Center** – The chief mitigating factor in phasing out the Center is the discontinuance of water withdrawal from those springs on Flint Ridge, which serve the center. This will restore their normal flow into the cave system, thus assuring an uninterrupted supply of nutrients to the animal life and continued geologic development. Similarly, there would be no more flow of pollutants into the caves from sewage and from the area occupied by the center, and the threat of damage from accidental spillage of petroleum products would be relieved.

When the center is phased out, the ground contours can be restored because the area was surveyed before the center was built.

- b. **Historic Entrance Area** – Total government and concessioner investment at Historic Entrance and at the “housekeeping” areas is about 3 million dollars. Much of this is represented by the campground and lodgings and their support facilities which were necessary for public accommodations when the park was a vacation destination. Of today’s visitors, 70 percent spend 4 hours or less in the park – long enough to take a cave trip, sightseeing boat ride, a hike, or eat a meal in the dining room or picnic area, and then be on their way elsewhere. Therefore, overnight facilities are needed no longer and are consuming park lands and resources by their presence.

In 1969, within an hour’s travel time of the park, there were 58 motels providing 2,300 units and 25 campgrounds with 7,633 sites all operated by private capital. More units have been added since. Within the park, the concessioner has 154 lodging units and the National Park Service has a 145-site campground. The concessioner operates, also, a dining room which serves 500 persons per hour, two small snack bars, a gasoline service station, a camper’s store, two curio shops, a dining

room within Mammoth Cave, and a bus transit system for transporting visitors to and from cave entrances. The present concession contract expires December 31, 1981. The government owns the structures containing 100 of the lodging units, and one each of the curio shops and snack bars.

Because the hotel, dining room, auto service station, and camper's store will be discontinued, it would appear that socio-economic impacts would become adverse. Such is not likely to be the case because affected employees should be able to work in the same fields in the expanding local labor market.

The concessioner does pay personal property tax to Edmonson County and this will fluctuate as the above services are discontinued and the level of other services increases. As the master plan is fulfilled, however, demand for new business and housing could be created, which would result in considerable net gain to Edmonson County.

Similarly, certain local merchants who supply the commodities used or sold by the concessioner will suffer loss of an account, but this, too, should be absorbed in the region's expanding tourism economy. The people visiting Cave Country will continue to require lodgings, food, automotive services, and the like. During the decade or two required for fulfillment of the master plan, the regional economy will adjust. If expected visitor projections are lower, or other circumstances occur, the plan could be delayed or modified.

By the time the peripheral staging area at Union City is ready for full operation, the conglomeration of buildings at Historic Entrance will have been dismantled with the possible exception of the Old Hotel. This building has been nominated for inclusion on the National Register of Historic Places along with the old Mammoth Cave Railroad train. If accepted, their disposition will be determined in consultation with the Advisory Council on Historic Preservation as required by Section 106 of the National Historic Preservation Act of 1966 (80 Stat. 915).

c. **Government and Concession "Housekeeping" Areas** — If a non-park site were developed for some or all of the "housekeeping" functions, affected personnel might prefer to live closer to it. Many park personnel are career employees subject to periodic transfer so rental housing at reasonable cost would have to be available. Private capital has not provided this in the past.

As time goes on, park housing will become outmoded and expensive to maintain. Whether or not government policy will allow replacement at that time remains to be seen. Meanwhile, no new housing will be constructed within the park for anticipated personnel increases.

5. Modify Intrapark Circulation

Of the 24-mile road system on Mammoth Cave Plateau, 11.6 miles will remain open to the public as scenic drives, after the transit system is fully operational. With the reduction of mileage, fewer rangers will be needed for road patrol and for assistance to motorists. The accident rate should be reduced also because there will be fewer vehicle miles traveled over park roads. Incidents of cave vandalism, such as removal of onyx, should be less frequent because people so inclined will not be able to drive vehicles as close to cave entries as heretofore. Similarly, fewer animals will be killed on the road. Overall road maintenance costs should be reduced significantly when the ultimate transit system is installed.

6. Utilize New Source of Domestic Water

If the park obtains its water from a water district outside, its account would help that district expand its system so that other customers could be served. This will encourage further development by private capital which will increase the tax base, offer new employment opportunities, and raise the standard of living in the region.

At times of low flow or damage to facilities outside the park, intra-district transfer of water and the park's own storage capacity would provide a temporary cushion, at least, against water shortage.

During late summer and early autumn, when water yield from springs is low, nearly all the water is diverted to domestic use resulting in slowing the normal geologic processes and reducing the flow of nutrients to the cave biota. Utilizing another source for domestic water will correct this degradation of the natural environment.

B. RIVER VALLEYS

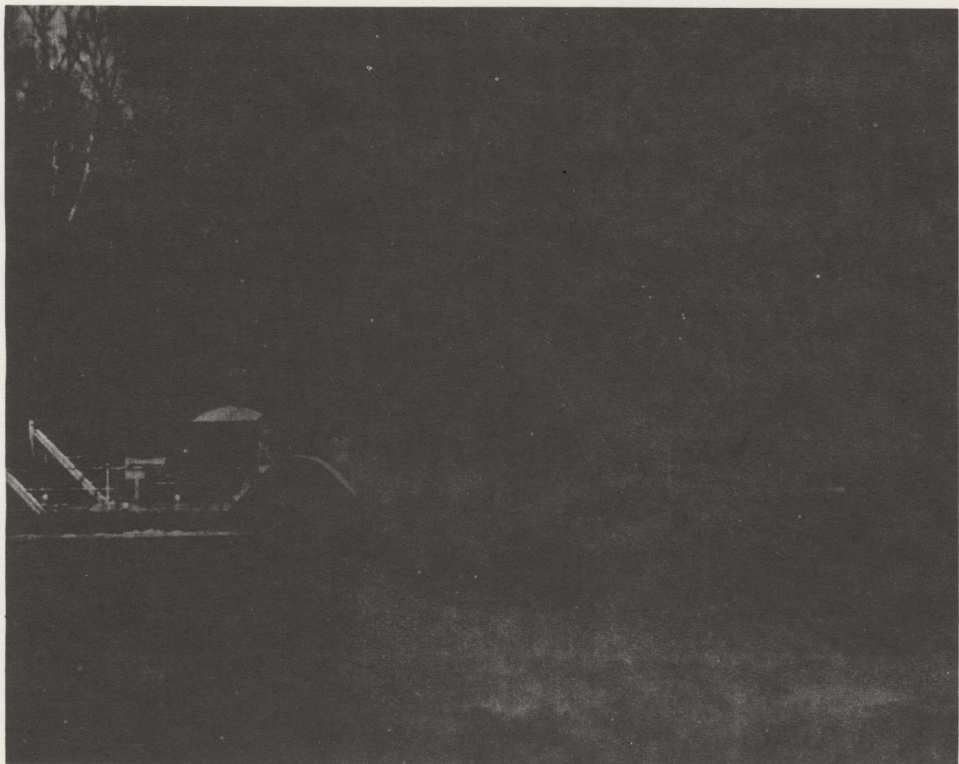
(See Section III, Part B)

7. Provide Additional Sites for Picnicking and Primitive Camping

Physical conditions inherent to the River Valleys constrict the development which can take place, and hence the use. Evidences of man's works and man's activities, once abandoned, would soon disappear because of periodic flooding and rapid growth of vegetation on the fertile alluvium of the floodplain.



Forested bluffs along a slackwater segment of the Green River.



Antiquated Houchins Ferry.

Nature enjoyment is one of the highest park uses and those attracted to the River Valleys should be able to look forward to this type of experience. Hence, greater development, even if it were possible, would not be in keeping with the charm which comes from remoteness and isolation. Because of heat, humidity, and noxious insects in the River Valleys during summer, many visitors may prefer to do their boating in late spring and autumn.

Boating on the Green and Nolin is an entirely different experience than on Corps of Engineers' reservoirs nearby. There, shoreline developments, water skiing, speed-boating, and houseboating establish an atmosphere foreign to either a "wild river" or "scenic river" experience which the master plan seeks to perpetuate at Mammoth Cave.

C. HILLY COUNTRY

(See Section III, Part C)

8. Build Transpark Road and Bridge

This road will maintain regional circulation and will improve existing conditions: by replacing two ferries, by removing two dusty, gravel roads, and by reducing transpark travel time and cost for local people as well as visitors to the region.

The Service is obligated by the road deed to maintain north-south circulation for the benefit of local people. The bridge will permit all-weather and 24-hour use. Neither is possible with the present ferry crossings.

A report commissioned by the Barren River Area Development District, Inc. (BRADD) titled *The Year 2000 — A Long Range Plan*, released in 1970, contains a recommendation for six new scenic routes within the 10-county region. Highest in priority of these and to be completed by 1980 is a road connecting US 31W and Nolin River Lake which includes, coincidentally, a transpark segment substantially on the alignment proposed in the park's master plan. The BRADD report recognized also the desirability of providing a closer tie between the recreational opportunities of the park and the lake.

Those who visit both Mammoth Cave National Park and Nolin River Lake use circuitous external roads because they are paved and travel time is shorter. Moreover, most users of impoundments bring their own boat along on a trailer. Generally cars pulling trailers cannot be ferried across the Green River. Of the park visitors using the ferries, only about 1 percent are headed for Nolin Lake. It is likely that more people will visit both areas on their vacation trip when the new transpark road is built.

The portion of Edmonson County between the park and the lake is isolated from the rest of the county with only the single road across Nolin Dam as an

outlet. The proposed transpark road would correct this, and at the same time, provide a scenic drive. The combination of Ky 70 across Joppa Ridge and the new transpark road would enhance motoring in Edmonson County for local people as well as park visitors.

Motorists will be able to obtain an inspiring view of the River Valley from the bridge, possibly unequalled in the region. As far as the eye can see, there will be unbroken hardwood forest which is probably the condition which would have been observed at this point in pre-Columbian times. The bridge itself, when completed, could be seen from the top of Brooks Knob fire lookout tower nearby, and travelers on the transpark road and river will be aware of it, but it will not be visible from any distant point.

Exposed earth cuts and fills will be stabilized with plantings to minimize erosion, and drainage structures will be spaced properly and be of adequate size. Drainage will be directed into normal runoff channels.

About 3 miles of the total of 5 miles along the tentative corridor for the road lies on the Caseyville Formation which is composed of sandstone, conglomerate, siltstone, and shale. This will be a good foundation for a road. About a mile will lie on the Glen Dean Limestone composed of limestone and shale; it is not cavernous. The balance of the roadway will be composed of the bridge and its approaches which will cut across several rock formations, and will pass over the alluvium beneath the bed and on the floodplain of the Green River.

Driving the present "ferry" roads is an unpleasant and hazardous experience in dry weather. Cars kick up great clouds of choking dust which cuts visibility. Roadside vegetation, coated thickly with dust, is unsightly and damaging to plant growth. The new transpark road will be paved and dust pollution will be eliminated.

Sand, cement, and gravel will come from sources outside the park, possibly those which supplied I-65 construction needs recently. The new road will probably have a bituminous surface like others in the park.

The new road will be open only to recreational traffic, so noise and exhaust emissions will be held to a minimum. Air pollution will be reduced further by eliminating current traffic backups at ferry landings. Vehicles idling or driving in stop and go traffic create a great deal more pollution, both atmospheric and from oil drippings, than those moving at moderate to high speeds. In addition to being a pleasant, low-speed drive through the woodland, when the forest becomes more mature, wildlife should be observed more frequently than at present. It will add a new "dimension" to

park use, by making easily available to the average visitor a part of the park few have seen before.

Because of the possibility that Indians may have occupied some of the terrain traversed by the proposed roadway, a reconnaissance will be made beforehand by professional archeologists.

A pavement width of 20 feet plus 3-foot shoulders is standard for minor roads in the national parks. The criteria spelled out in the booklet titled *Park Road Standards* will be followed in planning and designing the transpark road and bridge.

9. Establish Trail System

During the master plan study, it was determined that about 20 miles of hiking trails could be laid out easily in Hilly Country north of the Green between Nolin River and the Mammoth Cave Ferry Road. This is an area of 12-15,000 acres. If the trail bed were cleared to a width of 6 feet, about 15 acres would be devoted to hiking. This 20-mile trail system flanks the proposed transpark road.

To avoid new scars on the land, existing wagon road traces will be used wherever practical, and every technique to minimize erosion of the finished trail will be employed. Woody material removed from the 6-foot trail clearing will be cut into short pieces so that it will rot quickly by laying closer to the ground, thus adding nutrients to the soil and creating a new, albeit temporary, habitat. In addition, dead trees and limbs which might fall on passers-by will be cut.

There may be an increase of litter, vandalism, and poaching resulting from establishing a new trail system, but this may be prevented through education, interpretation, and enforcement of laws and regulations.

10. Develop Primitive Campsites

In our experience, it is far better for the resource to establish campsites at designated locations rather than to allow the hiker to camp wherever he chooses. An area designated and developed concentrates use; it can be serviced and patrolled; it reduces total damage to the environment; and the areas selected are adaptable to this kind of activity.

Providing a simple shelter will make it unnecessary for hikers to bring and carry their own tent. This would be of special benefit for school groups pursuing environmental education studies at Maple Springs.

When trailside campsites are established, patrolling rangers are especially watchful for forest fires, signs of poaching, and other unlawful acts. Violators are more likely to be apprehended. On the other hand, closer surveillance will probably reduce the number of these incidents.

Before primitive campsites are developed, the sites will be examined by professional archeologists or historians trained in the identification of historical, archeological, and paleontological resources; but in addition, workmen will be instructed to look out for such evidence so that if artifacts are uncovered which were missed on surface examination by the professional, work will stop and the professionals can reevaluate the find.

D. SUMMARY OF MEASURES TO MITIGATE ADVERSE EFFECTS OF THE PLAN

1. Water Quality

Sewage from the peripheral staging area, both in-cave comfort stations, and Historic Entrance transit station will all be carried by a trunk sewer line to the existing treatment plant near the Green River, which will be operated to meet all applicable county, State, and Federal standards.

By constructing sediment traps, soil pollution of underground streams will be prevented during construction.

Runoff from the parking lot at the peripheral staging area will be reduced by transpiration from the shade trees and stabilized turf, evaporation from the pavement, and percolation through dry wells and turf. That remaining will be channeled through dual lagoons to remove solids and petroleum products by a method approved by the Environmental Protection Agency (EPA). Water so treated will be superior in quality to runoff from agricultural lands, according to EPA. Overflow from the lagoons will enter surface stream channels and will eventually find its way underground.

When the present roadways and parking lots are closed, the quality of petroleum products washed into the caves from the transit roadbed will be insignificant compared with the drippings from tens of thousands of private cars.

Water quality in the cave is being monitored. If substances harmful to health are discovered, they will be traced to their source, if possible, within or outside the park, so corrective measures may be taken.

2. Water Supply

Purchasing water from an outside source is believed to be more economical to the government than withdrawing it from the Green River, and building and operating a treatment plant. As more customers tap onto the water main outside the park, water costs per user should drop.

Termination of the Great Onyx Civilian Conservation Center will release about 7.2 million gallons annually to flow into the caves. This will also

relieve peak season demands, when water yield from the springs begins to drop, until an outside water source becomes available.

The Kentucky legislature is in the process of considering criteria for land use in the Commonwealth. Mammoth Cave National Park plays a major role in the future of Cave Country. To this end, the Service is willing to cooperate with State, regional, or county agencies empowered to plan and control development in the region surrounding the park. Planned development and a high standard of service will go a long way towards maintaining the economic viability of the region. With water soon to be available in quantity, one of the chief constraints to development in the past will be lifted.

3. Air Quality

Carbon dioxide readings in the cave will be monitored. Should they ever reach toxic levels, steps will be taken immediately to discover the source and correct the problem. Toxicity is now believed to be unlikely because of natural air movements in the cave and the immensity of the passages. Temperature, humidity, and evaporation rate will be monitored also.

4. Vegetation

The peripheral staging area occupies old farmland only recently invaded by tree seedlings. When construction is finished, the area will be landscaped and the parking lot will be tree-shaded.

Wherever possible, the transit system roadbed and new roads and trails will incorporate old roads and trails to minimize clearing vegetation and cutting the larger trees.

Raw cuts and fills, ditch lines, and places where structures are razed will be seeded to prevent erosion and to hasten re-establishment of native vegetation. Trails will be surfaced when warranted by increasing use.

Although some savanna vegetation may be disturbed in Doyel Valley, other plant communities of this type in the park will not be affected by any development. None of the forest to be disturbed is old-growth; it is all in the process of regenerating as the vegetative cover re-establishes itself on land previously tilled, grazed, or cut-over. No rare or endangered species are present.

5. Wildlife

Habitats disturbed and species composition are both common to the park and region.

The probability of visitors seeing wildlife will be heightened through observations from transit vehicles, from personal cars traveling on the cross-park road, and from hiking and boating.

Wildlife will be disturbed in only 10 of the 53 miles of passages in Mammoth Cave. There some species will die out, but others will thrive in the new environment.

No endangered or rare species of wildlife, including troglobites, will be affected by the plan.

6. Cave Resources

Tunnel and elevator entries, previously constructed at Mammoth Cave, have posed no special problems in construction and have had no measurable deleterious effects, though not all were equipped with air locks. New entries will be closed with stout doors and air locks will be installed at elevator shafts, and at tunnel portals if warranted.

For the most part, cave passages shown previously will be reopened and lighted. Thus existing trails will need only to be upgraded to modern standards of safety. Of the remaining passages, much is not suitable for public use because of constricted space (crawlways), and flooding. The most advanced techniques known will be used in rebuilding trails and installing lighting to preserve aesthetics as much as possible.

Reopening the front parts of either Colossal, Crystal, or Great Onyx Caves for lantern tours is not expected to have deleterious effects other than litter and vandalism. These passages were developed for commercial tours before the caves were purchased for the park. Presence of two guides and parties not to exceed 40 each will tend to minimize damage.

7. Recreational Use

Less surface land will be devoted to intensive public use thereby allowing natural processes to operate with minimal interference by man's works and activities on the 45 percent of the park underlain by major cavern systems.

Except for some localized botanical habitats, Indian sites, "basin ecosystems," and scenic spots which may be damaged, more intensive use of the River Valleys and Hilly Country is an acceptable and highly desirable outdoor recreation pursuit, not yet developed to its full potential.

Even though the tick population of the park is heavy, and backcountry users are exposed to their bites, no incidents of contracting disease from these contacts have been reported. Moreover, exposure to noxious and

pestiferous forms of life and to the presence of danger is a daily challenge met by man everywhere and to which he must adjust as circumstances dictate.

8. Scenic Values

Not all scenic spots will be located along trails, nor will trails be built into "basin ecosystems." Nevertheless, these choice places are a vignette of what more of the park will become as the area reverts, over time, to a more pristine condition.

9. Land and Cave Passage Classifications

The Service has committed itself, through the master plan, to let nature hold sway over the bulk of roadless areas (76 percent) of the park. As pointed out earlier, certain essential public use and management activities must continue on Flint Ridge, and a small portion of Roadless Area B, in the extreme southwest corner will be cut off when the transpark road is built. Otherwise these wildlands will be managed by the Service essentially as they have been for the past 30 years.

Experience has shown that many areas remote from population centers, which were designated wilderness by Congress, have become so popular that they have deteriorated from overuse. Compared with most of these areas, Mammoth Cave's wildlands are tiny. They are accessible to 80 million people within a day's drive. Intensive use of trails on the highly erodable soils of the park may require surfacing and that would not be compatible with wilderness.

10. Visitor Services

It is unlikely that gross income to the concessioner will suffer in the future because increasing visitation will probably raise sales volume to compensate for loss of some services. Lodgings, dining, and camper's services will not be phased out for 10 to 15 years, or until the peripheral staging area is in full operation, thus allowing affected employees time to secure identical or similar jobs in the growing hotel and restaurant industry in the region.

In 1970, average annual occupancy rate of Mammoth Cave Hotel facilities was reported to be 50.2 percent, and 90-100 percent for the June-July-August period. Comparable figures for the motel-hotel facilities at Cave City were 58.6 and 93.3 percent, respectively. Since 1970, new motel and campground units have been built, indicative of private industries' response, in this area, to increasing travel.

11. Energy Consumption

Over time, it is probable that the activities phased out will more than offset

the additional electric energy requirements of cave lighting, elevators, and operation of new surface facilities.

Similarly, transit vehicle fuel consumption will be much less than operation of personal vehicles in the peak season. In 2000, 13,265 average daily cave visits are expected. This requires 3,800 automobiles. If these cars were driven the 11 miles between Union City and Historic Entrance and return, they would consume 3,800 gallons of gasoline. Buses moving the same number of people over the same distance would use only 750 gallons.

However, during the off-season, when passenger volume is less, transit operation could be more costly. This can be mitigated by running transit trips less frequently.

Presently, buses have a long, useful life and a high resale value. This should result in considerable savings in operating and amortization costs, as well as reduce costs if and when another transit vehicle is used in the ultimate system.

12. Adjacent Communities

The park plan should contribute strongly to the economic growth of the region. For example, by replacing the Houchins and Mammoth Cave Ferry Roads with the all-weather transpark road, regional transportation patterns will be retained and enhanced, and new business opportunities should develop.

V. ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

A. MAMMOTH CAVE PLATEAU

1. Expand Cave Trips

No one may travel beyond a cave entrance without light. Modern cave lighting for public tours requires wiring, switch boxes, transformers, and fixtures. Various techniques are used for "hiding" these objects, but none are totally successful, so this intrusion has a visual impact which is unavoidable. Moreover, the process of hiding what can be hidden, usually by burial or placement behind rocks in the shadows, is an intrusion upon the natural environment.

Except for spot lighting of certain features, cave lighting is at a low key. This is true especially in Mammoth Cave because the predominant color of the walls is grey and the cave dirt is brown. In these circumstances, trails must be built with special care for the safety of the visitor. Trails must be wide, have a smooth surface, and sharp projections must be avoided especially at head and shin level. Frequently, foreign materials must be brought in to assure a non-skid and strong wearing surface. Guard and hand rails, stairways, bridges, and the like are constructed of treated wood, metal, and concrete. Once a passage is developed for tours, it is modified forever. Even wood rots slowly in the constant temperature and humidity of the cave. These modifications and intrusions are unavoidable in developing caves for public tours where visitor safety is paramount and lighting is essential to viewing the passages.

Disturbance to cave life through loss of some habitat and gain in other habitats; visual intrusion of the lighting system and the trails; introduction of a higher level of carbon dioxide and odors from human traffic; scars of construction of elevator shaft, tunnel, trails, and lighting installation; vandalism and litter caused by construction and visitor use: these things cannot be mitigated entirely, but can be reduced somewhat through careful surveillance during and following construction.

2. Relocate Staging Area to Peripheral Site

Loss of habitat of the entire 35 acres, plus space required for entrance roadways, transit roadbed, and lagoons and the influence of the staging area itself on the surrounding park lands cannot be avoided. Similarly, rights-of-way for utility lines — electric, water, and sewer — will create scars, and these will heal in time, as will the scar created by widening 3/4 mile of Ky 70 to four lanes. Similar lands and habitats extend the length of Joppa Ridge.

While the staging area is undergoing development, some siltation of underground passages could occur despite every reasonable precaution, as the result of unexpected torrential rain. The area is subject to downpours during periodic electric storms. At worst, this might plug a natural drainage channel. Plugging and unplugging of sinkholes is of regular occurrence throughout the region, hence some siltation is a natural process.

There will be a greater volume of runoff from the parking lot and the roof of the terminal building than from the area with its present vegetative cover. Surface outflow from the site is now limited to wet-weather streams which owe their origin to temporary ponds and swamps. They overflow during the seven-month period from late December to mid-July. Thus, the cave fauna is adjusted to a five-month "drought." There will probably be an overall increase in quantity of water because of the parking lot and roof of the transit terminal, but the dual lagoon system should act in much the same way as the swamps do now with a gradual and continual outflow from December to August. There will be some outflow during the "dry" period because a heavy rain in the August-December period would probably result in some runoff which could not be absorbed. Additional water input to the caves should be beneficial rather than harmful.

Accidental spillage of sewage or water, because of pipe failure, is remote. If it did occur, extent of damage would depend on the location of the rupture. Soil erosion could produce an unsightly scar and result in temporary loss of vegetation. A severe line break in Doyel Valley would result in spillage of a maximum of about 3,800 gallons of sewage because the automatic check valve to be installed in the force main below the pumphouse at Union City would shut off the pump if there were loss of pressure. This quantity of spillage, entering an underground stream through a sink or fissure, would probably be unnoticeable, except that the nutrients introduced would add to the food supply of certain troglobites, but some other elements could be harmful to other troglobites. Of chief concern in a water main break would be soil pollution of an underground stream. This is of regular occurrence, however, as witnessed by the turbidity which prevails most of the year in the streams draining the Sinkhole Plain which pass through Mill Hole and Cedar Sink.

3. Extend Transit System

It is assumed that each passenger would pay a fee, as at present, to ride the transit system. This may result in a greater out-of-pocket* expense for many visitors, though the fare need not be high if the visitor volume continues to

* Contrast out-of-pocket expenses with operating costs discussed on page 121 under IV.A.3.

grow as anticipated. Offsetting this cost is the greater pleasure to be derived from a park visit undiverted by traffic, freer of air pollution, in a comfortable vehicle, and with a better understanding and appreciation of the park derived from information provided en route to destinations.

Any business venture entails risks. If there were a significant drop in visitation below projected levels, the concessioner could be in financial difficulties with an expanded bus fleet. Here again, bus resale value is high and if fleet reduction became necessary, much of the loss could be offset.

The transit roadbed and the pipelines across Doyel Valley will cause loss of habitat. Serious erosion damage could occur if there were torrential rains during the construction period or before the disturbed ground is stabilized by vegetation. An aerial telephone line now crosses the valley which was built during the time the area was farmed before the park was established.

4. Phase Out Existing Facilities

Each of the three sites represents a considerable capital investment, most of which cannot be offset by the salvage of the materials. Unsalvageable materials will have to be hauled outside the park and disposed of somewhere, probably in a sanitary land-fill. Some backfill will have to be hauled in to restore the contour of the ground especially where basements were excavated. Native trees and shrubs will be purchased and planted to hasten re-vegetation. This is to say that dollar costs of restoring the areas to their natural condition could be much greater than the salvage values recovered.

Some species of plants and animals associate themselves with man's works and activities. As these areas are reduced in the park, there will be fewer of them to illustrate the environmental education program which is of interest to many visitors.

5. Modify Intrapark Circulation

Many people who lived formerly on Mammoth Cave Plateau enjoy traveling over the road system. Most of the places where they or their friends used to live are impossible to locate any longer because physical remains are gone and vegetation has covered the old clearings. Just travelling over the roads brings back memories and the roads do traverse attractive tracts of second-growth hardwood forests. Of course, this experience will not be lost entirely, because transit vehicles will cover the same routes.

6. Utilize New Source of Domestic Water

Purchasing water from an outside source would have the least adverse effect on the park, and, generally, a strong beneficial effect on the region. Water delivered to the park, however, would deny its use to other potential customers in the District and to people living downstream from the intake. Much of the water would be returned to the region via the Green River following treatment.

B. RIVER VALLEYS

7. Provide Additional Sites for Picnicking and Primitive Camping

When the facilities at Houchins Ferry are completed, there will be a greater number of visitors' cars, boats, and boat trailers than at present and this will create some congestion in the parking lots and picnic areas. Similarly, there will be more motorboats on the slackwater portions of the Green and Nolin Rivers which will produce more noise, their wake will cause some bank erosion, petroleum products will be spilled while refueling motors, more fish will be caught, more litter will be discarded, and more accidents will occur. There will have to be a larger ranger staff to patrol the river. More trash will be removed from the picnic areas and the sanitary holding tanks at the new comfort stations will have to be pumped out periodically. Expansion of the picnic areas will result in partial loss of habitat on 4 or 5 acres of floodplain.

The primitive campsite at Dennison Ferry will be enlarged to accommodate 10 or 12 parties by clearing undergrowth from a few acres of floodplain forest, planting grass, and spreading gravel to form a small, stabilized turf parking area. The present gravel road will remain and be upgraded only to the extent of providing better drainage. Employees' time will be lessened on road maintenance, but increased for campsite cleanup and sanitation. This site is envisioned largely as a put-in point for float and canoe trips on the Green River.

Similarly, there will be a modest additional commitment of natural resources and manpower in establishing, maintaining, servicing, and policing the chain of primitive campsites, each 200-300 square feet in size, on some of the higher river islands.

C. HILLY COUNTRY

8. Build Transpark Road and Bridge

This will be the only bridge across the Green River along its 26-mile course across the park. The proposed site is 2.5-3 miles upstream from Houchins Ferry and about 6 miles upstream from lock and dam 6 at the park's west boundary.

From points within $\frac{1}{4}$ to $\frac{1}{2}$ mile, the bridge itself — its deck, railings, piers, headwalls — and the earth cuts and fills leading to it will always be a visual intrusion: to the river traveler, to the motorist, and to those at the top of the fire lookout tower on Brooks Knob.

The transpark road will not be visible from any viewpoint except Brooks Knob tower.

There will be additional runoff from the new roadway, compared with the old, because the new one will be wider. The present road, which is to be

replaced, is one to two lanes wide and has an impervious gravel surface, north of the river, but the roadway south of the river has little surface treatment and becomes rutted if traveled in wet weather.

More animals will be killed along the new road, because traffic will move more silently and at a higher speed. There will be no dust-laden vegetation along the roadside to deter browsing animals, and they will not be forewarned of approaching traffic as they have been with a gravel road.

Visitors will cause littering, vandalism and pollution, and there will be some ecosystem damage which cannot be mitigated. It is not likely that any habitat, unique to the park, will be destroyed or damaged along the alignment being considered for the road.

9. Establish Trail System

Where the trail must cross cliff lines, construction will scar the landscape. There will be some erosion of the trailbed during and following construction, which cannot be avoided. Vegetation will be lost in thickety places, but where the forest has reached some maturity, there is little undergrowth and only minor clearing would be required.

Tree stumps, scars on trunks where branches were cut off, pruning stubs, logs, and fresh grading of the trailbed will all be an eyesore for a time. Trees which must be felled in the process of clearing the trailbed, or as a safety measure, may damage other trees when they fall and this will be unsightly.

There will be some loss of habitat, food, and shelter for animal life, e.g., in the felling of a hollow, dead tree. On the other hand, some new habitats will be created along the trailside itself as microclimates are disturbed and as logs rot and become soil.

When new areas are developed, some people will drop litter, vandalize the trailside by carving in tree trunks, plucking wildflowers, etc.; and poaching may increase as the area becomes more accessible. Besides being a violation of law, it would be even more serious if an animal were killed, which is rare in the park.

There will be an investment of funds for construction and maintenance, and of funds and manpower for ranger patrol of these trails to assure proper care of them and to protect the countryside from fire and vandalism. Increased use will result also in more frequent encounters between man and noxious animals, and some, like stinging insects and poisonous snakes will be killed. Visitors will be exposed to poisonivy, stings, and bites, requiring first aid treatment. Some who stray from the beaten path may have to be sought out, causing more frequent emergency search and rescue operations with their expenditure of time, manpower, and funds.

10. Develop Primitive Campsites

Stubs of trees cut for firewood, axe marks on living trees, trampling of vegetation and other signs of use and mis-use are to be expected at and in the vicinity of any campsite, whether temporary or permanent.

Trees cut for building shelters will be a loss to the forest and cause a reduction in nesting sites and food supply for certain animals until replaced by new growth. For awhile, the stumps will remain and be unsightly. Limbs and tops will have to be disposed of by burning or by cutting them up into smaller pieces and allowing them to rot. It is unlikely that the latter procedure will cause an insect or disease infestation.

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

A. MAMMOTH CAVE PLATEAU

1. Expand Cave Trips

Mammoth Cave has been exploited commercially since 1809 with the mining of saltpeter followed by public tours commencing in 1816. Trails were constructed and have been rebuilt many times as visitation increased. Artificial entries by tunnel and elevator have been constructed. Cane torches carried by Woodland Indians smudged the ceilings with smoke as did the lanterns carried by explorers and visitors. Names and initials have been burned on and carved into walls and ceilings. The front part of Great Onyx, Crystal and Colossal Caves on Flint Ridge were developed also for public tours.

The master plan continues use of these passages and wisely holds expansion to those which have been developed previously, but are not shown now to the public. New artificial entries to Mammoth Cave, to make those routes accessible, are not expected to cause greater environmental effect than those constructed previously. Moreover, only 10 miles of the passages surveyed so far in Mammoth Cave and about 2 to 3 miles of Flint Ridge passages have been developed for public tours.

In spite of all the use and abuse of the past, the cave systems of the park are of uncommon worth to mankind because they still contain a population of primitive animals some of which are found nowhere else. The Flint Ridge Cave System is the longest (85 miles plus) and the Mammoth Cave System (45 miles plus) is the third longest in the world (see footnote p. 61).

It appears most unlikely that the projected public use of the caverns would endanger them unduly. Moreover, the National Park Service is committed by basic legislation, applicable also to Mammoth Cave National Park, to administer the cave resources for the "benefit and enjoyment of the people" while passing them on "unimpaired for the use of future generations." The master plan's proposals are within these guidelines.

More people will be able to enjoy a cave trip in the future under less-crowded conditions.

2. Relocate Staging Area to Peripheral Site

Relocating peripherally takes care of increasing visitation over the long-term and concentrates visitor impact in an area where park values are less important and less likely to create long-range damaging environmental

effects. Except for the chances of cave water contamination from the parking lot and a leak or break in the sewer line, which are considered improbable, the long-term advantages of the peripheral site outweigh the short-term degradation of park resources and low quality of visitor experience at Historic Entrance.

3. Extend Transit System

Removal of the staging area from Historic Entrance to Union City shortens by 11 miles the distance most visitors would drive in their personal cars. During the peak period in 2000, 13,265 average daily cave visits are expected. To bring this number of people to the park requires 3,800 automobiles. If all of these cars were driven the 11 miles mentioned, they would consume approximately 3,800 gallons of gasoline. Buses moving the same number of people over this same distance would use only 750 gallons. It is obvious that long-term productivity will be enhanced greatly by lessening demand on fossil fuel reserves.

Even though exploitation of Mammoth Cave and the ridge above it began in 1809, removal of visitors' cars from "Old 70" will reduce the level of pollution significantly, and this will help in offsetting the greater intensity of underground use occasioned by expansion of the cave trips.

Expansion of the bus fleet, initially, will add to employment both for operators and for fleet maintenance. This increase is likely to continue at a much higher level than at present, but is dependent somewhat on the type of transit system selected, installed and operated in the future. For example, some rail systems may be automated resulting in a net decrease in employment of operators.

4. Phase Out Existing Facilities

Though the gross adverse environmental impact of each area varies from the other, it could become much greater in each instance, if allowed to continue. Therefore, termination at the earliest practicable date, of each function, will allow natural forces to operate again untrammelled by man's works and activities.

Of the three areas, the immediate impact is greatest at Historic Entrance where the continuing increase in visitation is causing more rapid deterioration of the physical plant because use is more intensive than it was designed to accept. Regular use of grass areas for parking automobiles is compacting soil, reducing aeration and increasing erosion. Loss of shade trees will occur in time. In addition, the unsightliness of overflow parking and the

parking lot flows into Historic Entrance where the floor is sinking; runoff from the campground enters Mammoth Dome seen by 45 percent of the cave visitors. People taking shortcuts between the parking lot and Historic Entrance trail has resulted in loss of vegetation, caused erosion, and has turned a pleasant woodland vista into an unsightly eroded hillside. These conditions cause people to become more careless and vandalistic acts increase in number and in extent of damage.

By Congressional mandate, it is the mission of the National Park Service to preserve the area so that both present and future generations may enjoy it. Hence, the master plan calls for a peripheral parking lot of adequate size, a modern terminal structure, and a transit ride to cave entrances, boat dock, or trailheads. This will instill a feeling of anticipation in the visitor and enhance his appreciation for the great natural wonder he has come to visit and understand.

5. Modify Intrapark Circulation

Reducing mileage of park roads will result in lowering air and water pollution, and less fuel energy will be consumed in travel.

6. Utilize New Source of Domestic Water

Unacceptable damage to the Flint Ridge Cave System and its fauna is occurring from the withdrawal of water. Geological processes are being inhibited and troglobite populations may have been reduced by fluctuations in water quantity or reduction of nutrients transported by water. The seasonal fluctuations which will occur once natural flows are restored will have minimal effect in comparison.

Sociological and economic consequences of water purchase have far greater potential, both beneficial and adverse, than any effect on resource values. True, withdrawal of 27 million gallons per annum from Rio-Verde Spring, Green River, or Barren River, as the case may be, will reduce the amount available to other users in the respective water districts. Yet, the major role played by the park in the economy and general well being of Cave Country cannot be denied. Therefore, this commitment of water seems to be reasonable.

The following information was supplied by the District Chief, Water Resources Division, Geological Survey, Louisville, Kentucky: compared with the low flow of the Green and Barren Rivers, the park's withdrawal would be a "drop in the bucket." Low flows of the Green River are augmented by four Corps of Engineers' reservoirs: Green River Lake, Nolin River Lake, Barren River Lake, and Rough River Lake. The first two are upstream from Brownsville on the Green River. The seven-day minimum

discharge at Brownsville prior to regulation was 137 cfs (cubic feet per second) for the climatic years (year beginning April 1) 1925-30 and 1939-61. Regulated flows can be expected to be equal to or greater than this amount.

The minimum 7-day mean discharge for the climatic years 1939-62 was 22.4 cfs for the gaging station on Barren River near Pageville, Kentucky. This gaging station is now in Barren River Lake, but the flow record would represent part of the flow into Barren River Lake. The drainage area above the gaging station is 531 square miles as compared to the drainage area above the dam of 940 square miles.

Park needs are estimated at 27 million gallons per annum. Even if this amount is needed during 100 days (approximate length of season from Decoration Day to Labor Day), this would represent 270,000 gallons per day or 0.4 cfs, a considerably smaller quantity than discussed above as available flow in the Green and Barren Rivers.

A more critical factor, then, is the capacity of the system, particularly the treatment plant, to supply water to the users in the District. The reported capacity of the treatment plant of the Edmonson County Water District is about 180 million gallons per year (518,000 gallons per day) and present use is about 55 million gallons per year. An annual withdrawal of 27 million gallons for park use would be about 14 percent of treatment plant capacity.

Similar information is not available at this writing for the proposed Barren River Water District's treatment plant.

Estimated minimum flow of Rio-Verde Spring is 2.9 million gallons per day; treatment plant capacity is one million gallons per day. The Green River Valley Water District served 1,871 customers or about 6,500 people during the period December 1971 to November 1972 in the communities of Horse Cave, Cave City, and Hiseville. The average daily consumption was 577,100 gallons. The district's 5-year plan calls for expanding treatment plant capacity to 1.5 million gallons per day and 400 additional customers will be served. Even without treatment plant expansion, Green River Valley Water District could provide the park's water needs.

B. RIVER VALLEYS

7. Provide Additional Sites for Picnicking and Primitive Camping

Past use of riverbank developed areas at Mammoth Cave National Park has had no unacceptable effect on the environment. Space for expansion is quite limited, alluvium is a poor foundation, and periodic flooding precludes anything except temporary-type construction. Future development, therefore, is not expected to affect the environment to a significant degree above present development.

Similarly, river use can be deployed over 32 miles. The number of boats which can be launched in a day could not come near to saturating the resource and preventing the majority from having the enjoyable experience to which they are entitled. On peak days in 1972, as many as 15 motorboats and five canoes were launched. Boat use, especially motorized, is constricted by the very limited parking space available (see I.A.7.a.).

C. HILLY COUNTRY

8. Build Transpark Road and Bridge

Providing for increased visitor use of park lands north of the Green River was one of the objectives of the master plan. This wild land area is conducive to compatible outdoor activity of greater intensity than it has received in the past. The public is entitled to know better its scenic and natural resources. Many of the latter are of great interest to the scientist. Heretofore, the park's primary feature, for most visitors, has been Mammoth Cave. When the transpark road and bridge are built, visitors will find their park experience enhanced by a recreation visit to the Hilly Country and to Nolin River Lake.

The Federal Government investment in recreational facilities on Nolin River Lake is considerable. The following figures supplied by the Corps of Engineers, are for 1967: camping, 39,667; picnicking, 17,728; boating, 36,474; fishing, 102,905; hunting, 3,962; water skiing, 7,063; swimming, 4,461, or a total of 212,260 recreational visits, plus 128,923 nonrecreational visits (sightseeing), or a grand total of 341,183 for the year. This visitation could be increased materially and the capital improvements used more efficiently by the greater travel generated through construction of the transpark road. Both the park and the lake can accommodate more recreation visits.

9. Establish Trail System

Each year, since the park's establishment in 1941, has witnessed progression in return of the Hilly Country to a natural condition. Farming, grazing, and logging have ceased; hunting pressure has lessened. Thus, man's influence on the land has been relieved greatly. No one knows the exact composition of the forest and its wildlife which existed prior to man's exploitation of it. Some species like the American chestnut and passenger pigeon have become extinct, so the 19th-century environment can never be restored.

Still, the Hilly Country today is a valuable part of the American heritage, because it has had 30 years to recover from past uses of its resources. Here is a choice laboratory where dynamic natural processes may be observed and studied for the benefit of mankind. As long as the area remains a unit of the National Park System, it will be preserved from further spoliation. Yet man is entitled to use the area without abusing it and trail development and use is

compatible with this concept. Channeled use is preferable to casual use which is far more destructive of the environment and of resources, e.g., vegetation would be trampled, and accidents and lost person incidents would occur more frequently.

10. Develop Primitive Campsites

A developed campsite can be used for many years before it "wears out," depending on site conditions and intensity of use. Ordinarily it is good planning to select a site initially which is large enough so that use can be alternated to allow the area to recover. The two sites — First Creek Lake and Maple Springs — meet this criterion. Over the long term, experience demonstrates that developed campsites are less harmful to the resource than camping at random locations.

D. TRADE-OFFS

Inherent in the foregoing paragraphs of this section are some environmental trade-offs encompassed by the plan among which are:

1. Expanding cave trips to accommodate more people, to provide for a greater variety of experience, and to enhance the quality of the trip by reducing party size, requires more storage space for visitors' cars on the surface.
2. Larger parking lot capacity will only add to congestion at Historic Entrance. A peripheral site was selected.
3. Once relieved of their personal vehicles, visitors will be transported by public conveyance to cave entrances, boat dock, and trail heads with a concomitant reduction in energy consumption and pollution entering the caves.
4. Present facilities on Mammoth Cave Ridge become obsolete, once the peripheral area becomes functional, and will be phased out. Private industry and other public agencies will absorb certain functions as the park becomes predominantly day-use. Electric energy consumed in present developed areas will be used for the expanded cave trips and the new terminal building.
5. Future park water needs cannot be met from the present collection system on Flint Ridge, hence water will be purchased from an outside source. The flow of spring water will be restored to the caves thus assuring perpetuation of their fauna and continuance of normal geologic processes. If the water main is laid along Ky 70 to the park boundary, various tourist accommodations and services will spring up along it. This will change the

present rural approach to the park into a "strip" development*. Traffic problems will be created and a greater volume of waste will find its way underground. If carried into the caves by underground streams, the polluted water could kill the fauna and create public health problems, which would require closing Mammoth Cave to tours. Other sources of underground stream pollution are agricultural pesticides and fertilizers, petroleum products, and dumping of solid wastes and liquids into sinkholes.

6. Closing two antiquated ferries and their narrow, dusty approach roads and substituting a single transpark road and bridge will maintain long-established regional circulation patterns and make Mammoth Cave National Park and Nolin River Lake into a more completely integrated recreation unit.

7. The park is within 8 hours driving time of 43.1 million people (1970). Presently the Ohio River Valley contains adequate outdoor recreation opportunities for this population with its system of State resort parks, TVA and Corps of Engineers recreation lakes, and national forests. As the demand rises, some of it can be absorbed by the park's backcountry which will provide opportunities for river boating, hiking, and backpacking.

* No governmental body is empowered to control development. BRADD is the regional planning organization, but it has no enforcement powers in effectuating its plans. The Kentucky legislature is considering land use planning as this is being written. Too much development as well as substandard accommodations and services could discourage travel to the region.

**VII. IRREVERSIBLE AND IRRETRIEVABLE
COMMITMENTS OF RESOURCES WHICH WOULD BE
INVOLVED IN THE PROPOSED ACTION SHOULD
IT BE IMPLEMENTED**

A. MAMMOTH CAVE PLATEAU

1. Expand Cave Trips

Underground, the only totally new construction is boring the tunnel entry to Frozen Niagara and digging the elevator shaft to Star Chamber. If either became unused in the future, it could be sealed off and the entry camouflaged. However, once a natural cave passage has been altered from its pristine condition, it can never revert, because many of the natural processes which "heal" the surface of the earth do not operate underground. The passages were formed by running water and by solution. Neither of these processes can be restored because of geomorphologic changes which have taken place over time. Except for a catastrophe, man's alterations of the cave, physically and environmentally, will never be erased.

2. Relocate Staging Area to Peripheral Site

Except for the loss of some construction material which could not be salvaged, there appears to be no irreversible or irretrievable commitments of resources if this action is implemented. Development could be stopped at any point, or all the improvements could be removed following completion, and the area at Union City would revert, in time, to forest as it has been doing for the past 30 years. Moreover, the master plan calls for phasing out gradually at Historic Entrance and phasing in at Union City so that adjustments may be made in the plans for development dictated by changes in circumstances or new technology.

3. Extend Transit System

Regardless of the mode of transportation used ultimately, there will be an irretrievable commitment of resources in the form of energy consumed in the operation of the system.

Similarly, the manufacture and installation of the equipment will require an expenditure of energy offset only by its salvage value. At the present time, this value is believed to be higher for an all-bus system than for other types of surface transportation.

4. Phase Out Existing Facilities

Since this is, in reality, a sub-action dependent for its fulfillment on the three actions described above, it is unlikely that there will be any irretrievable or irreversible commitment of resources stemming from this action alone.

5. Modify Intrapark Circulation

It will always be possible to re-open the roadways to public travel in personal cars, should this become desirable in the future, so there appears to be no irretrievable or irreversible effects of this action.

6. Utilize New Source of Domestic Water

Park water use in 1970 was approximately 27 million gallons. This is rising each year visitation increases. Once the springs and wells in the park are disconnected and water is purchased, appropriated funds will have to be committed to an ever-increasing obligation. In a "tight" budget, this might cause curtailment of some other activity.

Concomitantly, the water district will have obligated itself to deliver sufficient water to the park to meet its needs in 2000. This, plus the water demands of other customers, does not appear to be a constraint at this time.

B. RIVER VALLEYS

7. Provide Additional Sites for Picnicking and Primitive Camping

Flooding and rapid growth of vegetation on the floodplain would "heal over" very rapidly any of man's works should they be abandoned after this proposal is implemented. Hence, nothing irreversible or irretrievable is involved in this action.

C. HILLY COUNTRY

8. Build Transpark Road and Bridge

The materials used in road and bridge construction, obtained off-site, could not be salvaged — sand, gravel, cement, aggregate, bitumen, steel, and the energy used to manufacture and place them. Fill material — soil and rock — obtained on-site might be retrieved, in part, as backfill along with pavement, bridge deck and piers, retaining walls, etc., should it ever be decided that the road should be obliterated.

As a practical matter, the bridge and the cuts and fills for the road prism leading to it will always be a visual intrusion, and the movement of ground water there will always be affected by the construction. The impact will be greatest on about 1/2 mile of the 5-mile corridor. That is the area involved in the river crossing.

9. Establish Trail System

While the trail clearing is to be 6 feet wide, the trailbed need be only 2 feet in width. Hence, the amount of grading will be minimal. The intent is to establish a primitive trail system with adequate attention to the safety of the user. Some steep places, however, will require movement of considerable earth to establish even a simple trail, and here the scar will last a long time after the trail is abandoned, should this occur.

Of greater concern, possibly, is the likelihood that a primitive foot trail may suffice for only a short time and use will increase to the point where widening and surfacing is required. Then more trail mileage might have to be added to accommodate more users. The impact on the resources would be increasing continually. If this situation develops, the National Park Service will have to weigh the alternatives carefully and decide on the solution which is then in the public interest.

It is possible that the trail system may make Indian rock shelters or village sites more accessible than heretofore. Some people may stray off the beaten path and discover one or more of these and vandalize them. Archeological investigations have been carried on in the park, but it is always possible that new sites will be located. It is to be hoped that such discoveries by visitors will be brought to the attention of park staff, so competent personnel can be brought in to study and evaluate them.

10. Develop Primitive Campsites

The Maple Springs campsite is to be located near a one-lane, gravel-surfaced, public road which is to remain open to provide access to Good Spring Church and cemetery. Church services are held now only on Decoration Day each year, and rarely on other occasions. Burials in the cemetery are becoming less frequent. The feeling of solitude predominates now, but, as time goes on, pressure may build to convert the primitive campsite to an auto campground. This would be untenable, for the draft master plan recommends that auto campgrounds be provided by private enterprise outside the park.

Once established, the campsites at First Creek Lake and at Maple Springs will require maintenance, clean-up, and ranger patrol thus committing men, material, and monetary resources to their up-keep. At both sites, normal vegetative growth would soon hide much of the area disturbed by development should either campsite be abandoned in the future.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

This section of the report is organized as the foregoing sections have been with three major headings — Mammoth Cave Plateau, River Valleys, and Hilly Country — representing the geographic areas of the park recognized by Congress as being of national significance. Following these three discussions, this section concludes with alternatives to the master plan's land and cave passage classifications and the Service's "no wilderness" proposal.

A. MAMMOTH CAVE PLATEAU

Any planning proposal which purports to resolve problems for a period of 30 years is hazardous at best. In doing so, the Service's basic assumption was that travel would continue to increase. It was recognized, however, that one or more of the following conditions could occur which would alter travel patterns and lessen the number of people or automobiles coming to the park. These are beyond control of the Secretary of the Interior:

- Major political, economic, or social crises affecting mobility of the population
- Major transportation shift from the family automobile to mass transit
- Drastic drop in population growth
- Staggered vacations by industry, a 4-day work week, and/or a quarter system in the public schools which could space visitation more evenly through the year and reduce the summer peak.

A temporary alteration would only postpone for a time the need for carrying out the proposal. If the shift was permanent, a different set of planning problems would arise from those which prevailed from 1968 through 1970. In those circumstances, a new study would have to be undertaken.

In its study, the master plan team identified the following problems and recognized their consequences if solutions were not found and implemented:

Major Problems

Parking lot overflowing
Visitor center overcrowded
Cave trips overloaded
Visitor services substandard
Physical plant deteriorating
Domestic water supply insufficient

Collective Future Consequences

Eventual adverse public reaction. Harm to the concessioner's businesses and to the region's economy which relies heavily on the drawing power of Mammoth Cave. Cave animals, and geological and mineralogical processes could be damaged further through lack of water.

The 1970 master plan's solution is in the form of an interrelated series of six actions to meet the needs of increasing visitation: expand cave trips, relocate staging area to a peripheral site, extend transit system, phase out existing facilities, modify intrapark circulation, and utilize a new source of domestic water. Increasing cave capacity is for naught without solving the problem of automobile storage on the surface.

The foregoing six interrelated actions have been described and their impacts discussed in the preceding pages of this report. Discussed below are the consequences of "no action" and the other alternates considered before the actions were selected that are explained in Section I.

1. Expand Cave Trips

Problem: For decades, Mammoth Cave was a vacation destination and visitors took leisurely cave trips. This has changed dramatically in recent years. During the 1950's, annual cave visits totaled about 200,000, but during the 1960's travel spiraled and in 1970 there were 611,000 cave visits. The rise is continuing and cave trips are overcrowded. In 1970, 78 percent of the visitors selected trips of 1-2 hours duration, equivalent to those in most commercial caves. Now day use predominates.

Solutions and Their Impacts:

a. **No action** — By doing nothing, the problem would not be solved nor could related actions of the master plan be carried out. Since the solution involves redeveloping passages previously used, developing a new tunnel and a new elevator entry, and rerouting and rescheduling trips, there is only a minimal commitment of resources. New entries have not had serious effects on the cave in the past. Therefore, it did not appear to be in the public interest to take "no action" which would have the effect of restricting visitation to the mid-1960 levels.

b. **Rerouting and rescheduling** — This is a matter of logistics to avoid overloading the Historic and Frozen Niagara portals, Snowball dining room, and places where passages intersect. Service personnel intimately acquainted with the arrangement of cave passages and tour operations demonstrated that the proposal was practical. Future tours meet the public's preference of 1-2 hours duration and will be both guided and semi-self-guided.

2. Relocate Staging Area to Peripheral Site

Problem: The "as-built" capacity of surface facilities at Historic Entrance is as follows: parking lot, 3,414 cave visits per day; visitor center, 4,000. During July and August 1970, an average of 1,000 visitors per day would have been turned away had this limit of 4,000 been imposed, but in June

about 780 more persons per day could have been accommodated. This overflow situation accompanied by parking on grassed areas, is expected to continue into the future, and it will worsen both in July and August and on weekends in spring and autumn.

Solutions and Their Impacts:

a. **No action or "freezing" visitation at the "as built" capacity of surface facilities at Historic Entrance** — This would have certain advantages including realizing the useful life of structures instead of accelerating their replacement through over-use; staffing and maintenance would continue at present levels; volume of travel would be stabilized so materials and supplies could be purchased at predetermined levels. On the other hand, tens of thousands of people could be denied a cave trip at the time of their convenience (though a workable reservation system might be established for a brief period of the year); economic growth in Cave Country and the Commonwealth as a whole would be lessened, although some business might be diverted to other caves in the region.

The foregoing sociological and economic considerations might be tenable if cave trips could not be expanded, or provision could not be made for greater surface use of the park. Therefore, the master plan calls for providing more facilities for more people in the park, within acceptable limits of impacts, while concurrently strengthening the local and regional economy.

The possibility of spreading use beyond the summer months was considered. It was assumed that 70 percent of the visitors spend one night or more away from home. The balance are local people. If they would make their visit sometime other than July and August, there would be some temporary relief from peak loadings. Many local people, however, cited the presence of out-of-State guests as the prime motive for their visit to the park.

The possibility of offering late afternoon and evening trips was explored. Present schedules are within a 10½-hour operational day with the peak occurring in early afternoon. Unless travel habits change, it is doubtful that extending the daily hours would accommodate significant numbers of people. Operational costs for guides, lighting, and bus services would be excessive per capita.

b. **Expanding facilities at Historic Entrance to meet increasing visitation** — Revamping the Historic Entrance area to accommodate projected travel by the year 2000 would require major alteration of the

appearance and use of the Historic Entrance area when 13,265 average daily cave visits and 3,800 vehicles are expected. Paved parking spaces would have to be expanded from the present 597 to 2,320 and this could be provided by building a multilevel, reinforced concrete, parking garage on the site of the present parking area, picnic area, and Woodland Cottages. The entrance road would have to be widened to four lanes for 6 miles back to Chaumont and a separate roadway provided for buses transporting visitors to the sightseeing boat dock and to cave entrances except Historic to which people would walk as at present. The bus road would have to overpass or underpass intersecting roads. The administration building would be remodelled to serve as an enlarged visitor center and transit terminal. A new park office building would have to be built probably in the vicinity of the utility area. Under this scheme, "Old 70" would be closed to private cars between Cox Store Road Junction and Carmichael Junction, and the entire Northtown Road would be closed so that the transit system could operate.

Expanding facilities at Historic Entrance would have the following impacts:

- The parking garage, 2½ stories high, with entry and exit ramps, would dominate the area and be an unsightly intrusion.
- More of the surface over cave passages would be paved increasing run-off of polluted water into Mammoth Cave.
- Campground would be retained, but could not be expanded. Amphitheater would be lost to the transit roadway.
- Woodland Cottages and picnic area would be lost to the parking garage. There would be no space to replace the picnic area.
- Hotel dining room could not be expanded, but could be converted to fast food service.
- More lodging units (50-75) could be built.
- Existing utility systems could be used, though a new water source would be required.
- Widening 6 miles of two-lane road to four lanes, across the karstic part of the park, would be a visual intrusion, run-off of polluted water into the cave system would increase greatly, and destruction

of forest and wildlife habitat would be considerable. Cuts and fills for widening the 1.6-mile segment of Sloans Crossing Road across Doyel Valley would have a greater impact on the underlying caves during construction than the ridge top sections. Beneath Doyel Valley is Roaring River, an underground stream, which contains a school of large blindfish. Soil pollution of this stream could cause loss of the fish and the stream habitat could be altered permanently by the four-lane road. The microclimate of Doyel Valley would surely be affected.

- On Mammoth Cave Ridge, 1.5 miles of the four-lane entrance road would be paralleled by two lanes of transit roadbed. In addition, overpasses or underpasses would be required: two crossings of the four-lane road and one crossing of a two-lane road. While these have not been designed, it appears that two would have to be underpasses. This is undesirable in this terrain because of drainage problems and the possibility of opening up fissures in the sandstone caprock. The overpass crossing four lanes would be unsightly and foreign to a national park environment.
- Once this major construction of roadways and parking garage was completed, the Historic Entrance area would be even more congested with people and cars in 2000 than it was in 1970.

c. **Relocate staging area outside park** — Two sites, adjacent to the southeast park boundary, were studied: near Cedar Hill Church and near Turleys Corner. The impacts of using either of these sites are as follows:

- Both sites would have to be purchased. The legislative process of authorizing funds for purchase of private lands, their acquisition, and then development would require too much time.
- The Cedar Hill Church site is in Edmonson County where there is strong opposition to taking more land off the tax rolls.
- The Turleys Corner site would require others to widen Ky 70-255 and that would affect established business, residential, and agricultural enterprises.
- Both sites are underlain with cavernous limestone and would be subject to the same constraints in development as a site now within the park. Neither is served by water or sewer.

- Transit system routes would be longer, requiring more vehicles and greater cost to the visitor.

d. **Relocate staging area inside park north of Green River or west of Turnhole Bend** — These sites have the distinct advantage of being outside the karstic area of the park. They were rejected early in the planning process because of logistical problems, and because they were too far removed from the Region's primary transportation corridor (I-65) with the large commitment of tourist-oriented business along it.

e. **Relocate staging area to peripheral site in southeast part of park** — Several sites on Joppa and Mammoth Cave Ridges were considered, but the choice was narrowed down to one on each ridge: Union City on the former and Frozen Niagara vicinity on the latter. The Union City site was selected and it is described and its impacts assessed in I.A.2., III.A.2., etc. in preceding parts of this report.

The Frozen Niagara site is located north of "Old 70" about $\frac{3}{4}$ mile inside the park boundary. It and the Union City site have a similar vegetative cover; are underlain by impervious sandstone which is a good foundation for construction; cave passages are beneath each site; electric service and water is nearby, but sewer is not; construction problems would be the same; and the same visitor facilities would be provided as at Union City.

Impacts unique to the Frozen Niagara site are:

- Extensive level land allowing considerable flexibility in siting parking lot and transit terminal building.
- Terminal could be located within a half mile walking distance of either Frozen Niagara or New Entrance portals.
- For transit to operate, "Old 70" would be closed westerly from the staging area, and Sloans Crossing, Mammoth Cave Ferry (including the ferry), and Northtown Roads would also be closed.
- Water and sewer lines would be shorter and not have to cross Doyel Valley.

The capacity of State road (Ky 255) from Turleys Corner 1.5 miles to the park boundary near Frozen Niagara staging area is inadequate to handle the volume of cars expected in the future. That segment would receive traffic from both Cave City and Park City interchanges on I-65.

Upgrading this road to four lanes will be costly including the additional right-of-way.

In time, the entire 5 miles of Ky 70-255 between Cave City interchange and Turleys Corner will have to be widened, for it would carry the majority of park traffic from I-65. This road is fast becoming lined with various business enterprises serving the tourist — souvenir sales, service stations, information booths promoting private caves, motels, chair lifts, pioneer village, wax museum, etc. Such enterprises could multiply quickly if the water main serving the park parallels Ky 70 west of Cave City. Once more business is established, cost of additional right-of-way to widen Ky 70 could become prohibitive.

Many park visitors prefer the open farmland and private residences which have characterized the Ky 70 approach to the park in past years. Unless some local action is taken, this will prevail only along the Mammoth Cave Parkway portion of Ky 255 between Park City and Chaumont. State highway planners foresaw the need for a parkway-type approach to the main park entrance from I-65 at Park City.

f. **Establish "satellite" visitor center at Frozen Niagara** — Under this scheme, the facilities at Historic Entrance would remain as presently constituted.

At Frozen Niagara, the government and the concessioner would provide and operate these facilities and services: parking lot, visitor center, restrooms, cave trip ticket sales, transit vehicles and loading dock, food services, curio sales, etc. To this extent dual facilities would be operated 3.5 miles apart on Mammoth Cave Ridge. This development at Frozen Niagara has the same advantages and constraints described in the preceding discussion. In addition, no park roads would have to be closed and congestion at Historic Entrance would be relieved. Traffic congestion on approach roads outside the park would be less since there would be two park entrances instead of one.

Providing these duplicate facilities and services so close together on Mammoth Cave Ridge would be a costly investment in plant and staffing for both the government and the concessioner. Two major staging areas would create confusion for the visitor in trying to choose in advance where to go and what cave trip to select. In a few years, cave visits will build up again to the point where both Historic Entrance and Frozen Niagara would be congested. In time, "Old 70" would have to be straightened and widened to carry the additional traffic flow. At best, the idea of a satellite visitor center would be a short-term solution.

3. Extend Transit System

Problem: The purpose of establishing a peripheral staging area is to provide adequate space for storing personal automobiles while their occupants are on a cave or sightseeing boat trip, or hiking the surface trails in the southeast part of the park. Distance to these points is too great for the average person to walk from the staging area.

Solutions and Their Impacts:

a. **No Action** — This proposal is integral to fulfillment of the plan as outlined. If it is not carried out, present uses of the park will continue with the impacts prevailing which were cited previously.

b. **Method of conveyance** — This will not be determined until Historic Entrance facilities are phased out and the peripheral staging area is ready for full use. The state of technology is advancing and a different transit system than any known now may be selected after a full assessment of its impacts. The ultimate system could be on a surface road or rail, elevated, aerial, air cushion, or some other.

Since buses are being used now for this purpose from the Historic Entrance staging area, it seems logical to add to this fleet at the outset and to continue to use buses until a better system is planned.

In any event, a transit system reduces greatly air and water pollution, consumption of energy, and cost per individual transported compared with private automobiles. There will also be an opportunity to provide transit vehicle passengers with interpretive messages while enroute to their destinations.

4. Phase Out Existing Facilities

Problem: The impact of existing facilities upon the cave systems and other park resources is too great. These facilities include the Great Onyx Civilian Conservation Center on Flint Ridge, and the government and concessioner facilities on Mammoth Cave Ridge. Damage is cumulative and accelerates with overuse; presence of danger from gasoline and fuel oil storage and transport poses a serious threat to the underlying caves in the event of accident.

Solutions and Their Impacts:

a. **No action** — The Service could continue to live with the problem for the indefinite future. This would postpone or preclude corrective action and continue the threat of serious damage. Moreover, restoration of natural conditions and of the natural appearance of the sites would be delayed. Other actions considered were termination, and relocation.

b. **Termination** — This course of action was deemed viable for the Conservation Center, but not for the government and concessioner facilities on Mammoth Cave Ridge. The latter are an integral part of park visitor operations involving both government and concessioner personnel. When the Center is closed down, the 214 corpsmen will return to their homes having completed their training in manual trades skills; local expenditures for salaries, supplies, etc. (\$1.6 million in FY 1969) will end; staff will lose their jobs; buildings will be razed, and surface contours and native vegetation restored. Suitable on-job work training projects in the park and region are no longer available. Of the 27 million gallons of water used annually in the park, the Center consumes 7.2 million gallons or about 60 gallons per day per person. This water will be available for other park uses. Buildings are heated electrically except for staff trailer housing which uses fuel oil. The danger of leakage into the caves, from the 4,000-gallon diesel oil and gasoline storage tanks and from the sewage system, will end.

c. **Relocation** — The Service proposed relocation of the Center to a non-karstic part of the park near Arthur. This site met with strong local opposition. Relocation of the government and concessioner facilities on Mammoth Cave Ridge is the recommendation in the plan, discussed previously in this document.

5. **Modify Intrapark Circulation**

Problem: In order for a transit system to operate most efficiently, it must have its own roadbed so as not to be competitive with other forms of transportation.

Solutions and Their Impacts:

a. **No action** — The present transit system uses the same roadway as private cars over most of its route. These roads are becoming more congested making it impossible for the buses serving cave entrances to keep their schedule during certain hours of the day during the travel season. Without action, the condition will worsen.

b. **Widening existing roads and building new parking lots** — The present bus system could be discontinued if roads were widened and parking lots provided at each cave entrance. The additional grading and paving required would result in loss of habitat and be detrimental hydroecologically to the underlying caves. At each cave entrance, also, tickets would have to be sold, a staff of guides made available, a shelter and comfort station built. In sum, the total investment would be much greater than at present in staff, facilities, and physical plant. Trips which enter at one portal and exit at another would have to be

discontinued for lack of a surface transit connection. In time, congestion would occur at each cave portal instead of at Historic Entrance alone.

c. **Build paralleling transit roadbed** — This solution was considered above under VIII.A.2.b. with the discussion of expanding facilities at Historic Entrance. In brief, this is undesirable because of the loss of forest habitat, the additional polluted runoff entering the caves, and the unsightliness of underpasses and overpasses required for separating transit from private vehicular traffic.

6. Utilize New Source of Domestic Water

Problem: Water consumption is fast increasing and present supply from in-park springs and wells will not meet future requirements.

Solutions and Their Impacts:

a. **No action** — As travel and water consumption increase, there will be times when water shortages will occur. In these circumstances, emergency measures would have to be instituted such as curtailing water for certain activities such as closing the campground, and hauling water from an outside source. Moreover, reserve supplies would be low for building fire suppression.

Once the Great Onyx Civilian Conservation Center is terminated about 7.2 million gallons of water will be available annually for other park needs, thus postponing the time of shortage. By August 2000 water consumption at the peripheral staging area alone will match present levels.

b. **Provide more storage capacity and drill more wells** — Presently the park's storage capacity is 1,750,000 gallons. This could be expanded. More wells could be drilled but yield is low, and water quality is poor, being high in sulfates. No more springs can be tapped so their purer water could not be used to dilute the additional well water. Furthermore, ground water yield is lowest in late summer and early fall when demand is high. This solution would not be desirable because it still relies on the park's ground water which is needed for the continuing geological development of the caves, and to supply nutrients and provide habitat for the cave animals.

c. **Develop in-park source** — Several sources were identified, described and analyzed in Geological Survey Water-Supply Paper 1475-Q (1965). Of these, Green River was recommended as the best source. To utilize it requires the Service to construct an intake structure

with pump on the river bank, pipeline to the treatment plant to be built, and pipeline to the existing storage tanks on Flint Ridge and Mammoth Cave Ridge. A second pump might be required in the distribution system depending on the elevation of the treatment plant. Any site selected for these works would result in destruction of vegetation and habitat, and be a visual intrusion. The degree of impact would vary somewhat with the site, but the plant itself would be of the same size wherever located. Pumping would require a considerable commitment of electrical energy. Treatment of Green River water would probably entail filtration, coagulation, and chemical additives to meet all standards for safe drinking water. Operating costs, especially for salaries, would be an ever-increasing demand on the monetary resources available to the National Park Service. By contrast, purchase of water is expected to be less expensive.

An in-park treatment plant would inhibit regional development to the extent that the park's need for outside water prompted extension of a water main to its boundary. Private industry mostly catering to tourists would tap the water main and develop facilities along it outside the park. Such expansion is constrained now for lack of a water distribution system, and the absence of a sewer district.

B. RIVER VALLEYS

7. Provide Additional Sites for Picnicking and Primitive Camping

Problem: The master plan seeks to perpetuate the "wild rivers" character of this unit of the park, but it can accept more use. However, development on the floodplain is constrained by annual, or at least, periodic inundation. Alluvium is a poor foundation for structures.

Solution and Their Impacts:

- a. **No action** — None is required at present because volume of use matches existing facilities. Those at Houchins and Dennison Ferries can be more than doubled in capacity at reasonable cost, but further expansion is constricted by terrain. Primitive campsites established on selected river islands, though flooded annually, will help to encourage more canoe and float trips on the rivers and will avoid damage caused by indiscriminate camping and littering.

C. HILLY COUNTRY

8. Build Transpark Road and Bridge

Problem: North-south travel across the park is accomplished over two gravel roads and their antiquated ferries. The roads are narrow and dusty, sight distance is limited, the ferries are closed between 11 p.m. and 6 a.m. and during periods of high water, and the Service is obligated to keep these

roads open because of a deed reservation. Commuters use the ferries en route to and from work. A direct connection between the park and Nolin River Lake is desirable for regional development. Better access to the Hilly Country will encourage more use.

Solutions and Their Impacts:

a. **No action** — Ferries are disappearing and their continuation would perpetuate a facet of "living history." On the other hand, traffic over the roads is increasing causing backups at the ferries and potential rise in the accident rate as more cars travel the one-lane approach roads in their present condition. There are alternate roads, however, outside the park, built to modern standards. Traffic might be encouraged to use them. To do so would cause visitors to have no contact with the scenic Hilly Country and its trail system proposed in the master plan.

b. **Replace ferries with pontoon bridge and treat road surface to relieve dust** — These "improvements" would increase traffic volume because the trip would be more pleasant without the dust and the wait for the river crossing would be shortened or relieved entirely if there was no oncoming traffic.

Surface treatment of the road would not be sufficient. It would have to be widened as well and realigned in places to improve safety. It is questionable that a pontoon bridge would be practical. As the river rises and falls, because of fluctuations in flow, personnel would have to be available to extend or shorten the deck and add or subtract pontoons. At times of flood, the pontoons are likely to be damaged or sunk by floating debris which is the prime hazard faced by the ferry boats. If the Mammoth Cave Ferry is retained, the master plan could not be carried out. The plan is predicated upon a transit system operating on its own roadbed and providing service to the sightseeing boat dock as well as to cave entrances and trailheads south of the river.

c. **Other corridors for transpark road** — The only solution to an all-year, all-weather crossing is to bridge the Green River. Before the transpark road is built, other corridors than the one selected in the master plan will be studied and evaluated, including its bridge site. It was beyond the scope of the master plan to conduct detailed engineering studies. A road corridor east of Turnhole Bend is untenable because of the presence of the cave systems. A bridge at Turnhole Bend would destroy the most spectacular river valley scenery in the park and a classic example of an incised meander. The site of Houchins Ferry is an alternate possibility for a bridge.

Among other considerations in selecting a road corridor are engineering standards, soil conditions, and effect on natural, historical, and scenic features and resources.

d. Effect of Kentucky's Wild Rivers Act — To build the transpark road and bridge would be in violation of the Wild Rivers Act of the Commonwealth of Kentucky (Chapter 146, Kentucky Revised Statutes, 1972) as are the present activities on the Green River of motorboating, the sightseeing boat trip, access to the river at the Dennison Ferry site, and the Houchins and Mammoth Cave ferry operations with their approach roads required by deed reservations. See II.B.1., p. 83.

e. Route outside park — A north-south scenic route could be constructed east of the park between Highland Springs and Wax, which would accomplish the same purpose in regional circulation as the transpark road and bridge. It, too, would require a bridge across Green River. Much of the right-of-way would be over private lands and would involve entirely new construction. The section between Highland Springs vicinity northward to the Green River crosses the eastern portion of the Mammoth Cave Plateau which is dissected there also by sinks and solution valleys. A road across the Plateau would be subject to the same constraints in protecting underground values as a road across similar terrain in the park. It could bring pressure to bear upon the park to open an east entrance to Flint Ridge. If a road were built in this corridor, it would be in the province of the Kentucky Department of Highways since no Federal land is involved. Unless the right-of-way was protected by limited access and scenic easement agreements, it would open up a new area for development which could be detrimental to the park. It is best that the park's integrity not be compromised and that its environs remain in small farms and woodlots.

9. Establish Trail System

Problem: The master plan calls for trail heads along the transpark road so the Hilly Country with its scenic and natural values will be more accessible and become better known.

Solutions and Their Impacts:

a. No action — A facet of the park unknown to most visitors and of national significance would generally remain inaccessible if trails are not built. On the other hand, fishermen have beaten down their own trails to First Creek Lake and Nolin River Valley, but this is substandard for general public use. It is still possible to follow segments of old wagon roads which have not fully revegetated so as to block passage. These could be brushed out but would not offer the scenic interest and views

of natural objects that a trail system would be laid out by professional landscape architects and engineers.

b. **Substitute one-way motor nature trails for hiking trails** — It has been suggested that a one-way motor nature trail system be laid out in lieu of, or to supplement, the hiking trails recommended in the master plan. These would be very destructive of the resource in that the topography is rugged, cuts and fills would be deep, bridges and drainage structures would be required, surfacing would be needed, much more habitat would be destroyed, landscape scars would be greater, and commitment of funds for construction and maintenance would be many times larger. It would be possible to connect the Houchins Ferry and Mammoth Cave Ferry Roads with an east-west motor nature trail, about 4 miles long, across the top of the watershed and just within the north park boundary. This would involve both new construction and rebuilding segments of old wagon road traces. It is difficult to see the merit of such a road after weighing its deleterious effects on the watersheds it crosses. One of these, the Wet Prong of Buffalo Creek, contains some of the finest scenery in the park along a cool stream which runs clear all season long.

10. **Develop Primitive Campsites**

Problem: Providing primitive campsites would add further incentive for visitors to become acquainted with the Hilly Country.

Solutions and Their Impacts:

a. **No action** — None is required until use builds up. Established sites are preferable to allowing the hiker to camp wherever he chooses. A designated area concentrates use; it can be serviced and patrolled; it reduces total damage to the environment; the areas selected are adaptable to this kind of activity.

D. **ALTERNATIVE WILDERNESS PROPOSALS**

The following wilderness proposals, listed in order of decreasing wilderness acreage, were considered in the planning process:

1. **National Parks Association (now National Parks and Conservation Association) Proposal**

a. **Proposal** — After conducting an independent study of the park's surface area and cave passages in 1967, the National Parks Association recommended that 96 percent of the surface area (47,000 acres) be designated wilderness, as shown on plate 1. Four visitor-use areas were excluded from wilderness: the existing major visitor-use area and cave



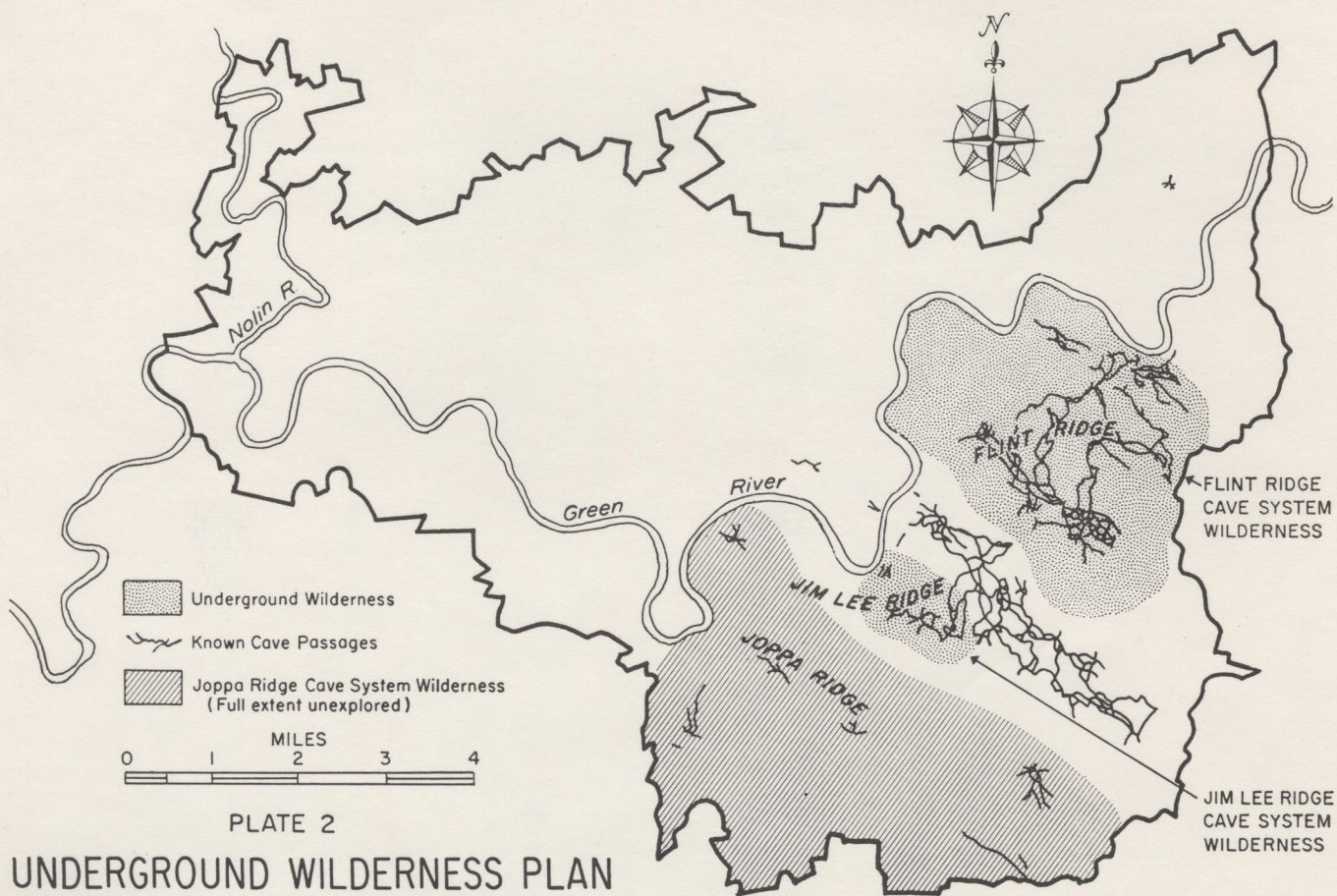


PLATE 2

UNDERGROUND WILDERNESS PLAN FOR MAMMOTH CAVE NATIONAL PARK

Federal Graphics,

NATIONAL PARKS MAGAZINE

JAN. 1968

entries along Mammoth Cave Ridge (2,520 acres), a potential future visitor access area south of the Green River near Cedar Sink (403 acres), a future visitors' reception area on the north central park boundary near Lincoln School (403 acres), and the Maple Springs Ranger Station area (288 acres). Access corridors, totaling about 40 acres, to Temple Hill Cemetery, Wilkins Cemetery, the Maple Springs Ranger Station, and the Great Onyx Civilian Conservation Center (i.e., Job Corps Camp on plate 1) are also excluded.

In addition to the surface wilderness, the National Parks Association also recommended that cave passages underlying Flint, Jim Lee, and Joppa Ridges be designated underground wilderness (plate 2). The 6 miles of passages open to visitors in Mammoth Cave, along with about 44 miles of presently unused passages, are excluded from the underground wilderness area. Passages that may lie beneath valleys peripheral to the recommended wilderness are also excluded.

b. Impacts

(1). **Impacts on vegetation and wildlife.** The park presently supports a diverse mosaic of vegetation, which developed as a result of the area's long history of logging and agricultural uses prior to establishment of the park. Old fields in various stages of succession are widespread, and they provide valuable habitat for mourning doves, bobwhite, opossums, raccoons, rabbits, mice, voles, and Virginia white-tailed deer. Many of the species, such as deer and opossum, which require oldfield or early regrowth forest habitat, are valuable game animals. Others, such as field mice and meadow voles, provide an important food source for red fox, grey fox, bobcat, and various predatory birds such as the horned owl and the loggerhead shrike. Since establishment of the park in 1941, lack of vegetation management has allowed succession to proceed toward the climax oak/hickory forest, and the diversity of habitat for wildlife has been declining. During the past 30 years, the populations of at least 35 species of birds have declined, about 49 have remained relatively stable, and about 30 have increased (Wilson 1968). In general, species requiring mature forest habitat have increased at the expense of those requiring successional habitats.

The impacts of the recommended wilderness on vegetation and wildlife result from the preclusion of non-primitive land use and the restrictions on resource management techniques. On the one hand, long-term preclusion of development will ensure protection

of these natural resources and will allow the reestablishment of mature climax vegetation, which is now regionally rare because of the area's long record of disturbance. The value of the wilderness area as an undisturbed natural reserve will increase as regional development and economic growth continue to claim progressively more acreage. On the other hand, restrictions on the use of mechanized equipment in the wilderness will impair the ability of the National Park Service to manage the environment in ways that will create the optimal diversity of plant communities and wildlife populations. Wilderness designation, in effect, would commit the National Park Service to allow the reestablishment of pre-Columbian ecological conditions before the long-term implications of this management policy have been determined for the park.

The Virginia white-tailed deer is the region's principal big game species. In the park, the deer population has declined substantially during the past 15 years (present population estimated at 2,400 animals). Although no hunting is allowed in the park, the Kentucky State Fish and Game Commission traps about 5 percent of the park's population annually for release on State lands outside the park. If the proposed wilderness resulted in further declines in the park's deer population due to losses in suitable habitat, the State's trapping program would be less productive, the number of deer emigrations onto private lands where deer may be hunted would be less, and the quality of hunting as a regional recreational activity would be reduced to an unknown degree. Similar, but probably less significant regional impacts on hunting, could result from long-term declines in populations of mourning doves, opossums, and raccoons in the park.

The proposed underground wilderness designation will have no immediate impact on cave life, because these passages receive only occasional use by visitors. However, the National Park Service will be permanently prevented from developing the designated passages for general public use and interpretation. This action will also ensure that the cave biota has minimal disturbance from man's activities. Similarly, surface wilderness designation precludes development on 96 percent of the park's acreage. Such developments could cause pollution of groundwater and thereby indirectly impair the integrity of cave life. However, the wilderness will have no impact on land uses outside the park, but some uses on the groundwater watershed outside the park could be harmful

to the animal life of the caves. This could stem from pollution of groundwater by sewage, by leaching of materials placed in sinkholes, by road runoff, and by accidental spills of toxic materials. The potential of these impacts on cave life generated from outside the park could exceed by several orders of magnitude the potential impacts from future in-park use or development.

(2). **Impacts on cave features.** The proposed surface wilderness will have no immediate effect on the integrity of the physical features of the cave system. Long-term protection of these features may be enhanced by the restrictions wilderness designation places on the development and use of park lands.

The probability of groundwater pollution from in-park sources will be negligible in the wilderness area. However, polluted groundwater from sources outside the park could disrupt the active growth of flowstone in passages within the phreatic zone.

The proposed underground wilderness will preclude development of additional visitor-use areas outside the 50-mile network of passages in Mammoth Cave itself. Thus, Mammoth Cave will continue to receive impacts of visitor use, such as vandalism and littering. An analysis of existing visitor-use data collected during the master plan study indicates that Mammoth Cave can be developed to accommodate potential increases in visitation through the year 2000, provided additional entrances are established, presently unused passages redeveloped for visitor use, and scheduling of cave trips rigidly controlled. Damage to cave features within Mammoth Cave probably can be controlled within acceptable limits by park management, at least until the end of this century. Ultimately, if visitation exceeds the carrying capacity of the cave to sustain use, and if wilderness precludes redistribution of use into other areas, a permit system might have to be implemented. Such restrictions would inconvenience the visitor and cause congestion in aboveground areas of the park. The probability that such impacts would ever occur remains speculative.

(3). **Impacts on esthetics.** The proposed surface wilderness will result in a decline in esthetic diversity as a result of plant succession, which will eventually reestablish the oak/hickory climax forest association as the predominant feature of the landscape. Clearings, oldfields, and regrowth thickets will become

progressively less conspicuous features. The mature forest will provide to the wilderness user substantially greater isolation from the sights and sounds of human civilization; the atmosphere of solitude therefore will be enhanced for many users. The determination of whether decreased esthetic diversity and increased solitude constitute adverse or beneficial impacts will depend on how the environment is perceived by the individual wilderness user.

(4). Impacts on access and circulation. The proposed surface wilderness, as described on plate 1, would entail closure of several access highways into the park. The 8-mile section of State 70 across the Woolsey Valley wilderness would have to be closed. This route, which connects the Green River Parkway to the west and Interstate 65 to the east, receives moderate traffic by local residents as well as substantial use by commercial vehicles. The extent to which park visitors, local residents, and commercial interests contribute to the total traffic flow (about 450,000 vehicles per year) has never been determined, but it is likely that more than half of the total traffic is not park related. Closure of this section of State 70 would inconvenience park visitors arriving from the west who would have to follow circuitous alternative routes to get to the principal visitor-use area on Mammoth Cave Ridge. Local residents and commercial interests would experience time delays as long as 20-30 minutes in traveling from the junction of highways 70 and 255 at the southeastern boundary of the park to the town of Brownsville immediately west of the park. Access to a small church and adjoining cemetery on Joppa Ridge as well as to a small cemetery on State 70 near the southeastern park boundary would be restricted and, in the former case, nearly impossible. Public use of these areas is minor, but the impact would be significant to those affected by closure of the road.

The proposal would require closure of all in-park roads providing access to, or ferry crossings over, the Green River. Existing roads between State 70 and Temple Hill Cemetery with a ferry crossing (not shown on plate 1), between the visitor-use area on Mammoth Cave Ridge and the Maple Springs Ranger Station with ferry crossing (not shown on plate 1), and an access road to the Green River in the northeastern part of the park would all be closed. These closures would have impacts on circulation within the park by eliminating all transpark traffic and road access to the Green River. Travel time between the Mammoth Cave visitor-use area and

the Maple Springs Ranger Station would require a 40 mile 1 hour drive via the existing external roads. The inconvenience which the wilderness proposal entails would be less in driving between other points, but would still be a significant impact.

(5). **Impacts on recreational use and development.** The surface wilderness proposal, if implemented, would result in a substantial reduction in the diversity of recreational opportunities. The Green River would be inaccessible by private automobile within the park. Launching of private motorboats and use of the existing concession-operated 125-passenger sightseeing boat on the river would no longer occur. Use of rubber rafts and canoes on the river would decline, because visitors would have to carry them on foot for considerable distances to get to suitable launch sites (most of the river is flanked by steep cliffs, which preclude boat launching). A picnic area along the road to Temple Hill Cemetery south of the Green River would no longer be accessible by automobile and would be about a mile walk from the nearest road access; use of the picnic area would decline. A primitive campsite and popular boat launch site south of the Green River in the northeastern corner of the park that is now accessible by road would be about a 2-mile walk from the road terminus at the park boundary; use of this facility also would decline. Twelve primitive campsites situated on islands in the Green River and used by individuals or small groups would receive much less use due to difficult access to the river for boat launching. The wilderness proposal would have no impact on existing recreational use of the remainder of the designated area, which is used only for backcountry hiking and primitive camping. The master plan contemplates no change in the types of use in this area, so impacts on use in the foreseeable future would likewise be negligible.

The surface wilderness proposal would have substantial impacts on future development of 96 percent of the park. The wilderness designation would preclude construction of a transpark road with a bridge over the Green River. North-south vehicular travel through the park would be permanently impeded. However, natural resources and esthetic quality would not be impaired by construction activities and the presence of a major road.

Development of interpretive facilities in two presently unused caves (Great Onyx Cave and Crystal Cave) on Flint Ridge, as well as other potential sites, would be difficult after the land above

them was designated wilderness, because the only access would be on foot. Foreclosure of the option to initiate additional development near other interpretive sites will tend to concentrate future development on limited available acreage at Mammoth Cave Ridge. If visitation continues to increase, exacerbation of an existing crowding problem and a general deterioration of environmental quality will have significant impacts on the visitor experience. Opportunities to relieve congestion by dispersion of development will be foreclosed. Development of campgrounds, nature trails, and interpretive facilities on non-karst land north of the Green River would no longer be possible. The master plan proposes no such facilities, so impacts due to foreclosure of this option would be negligible in the foreseeable future.

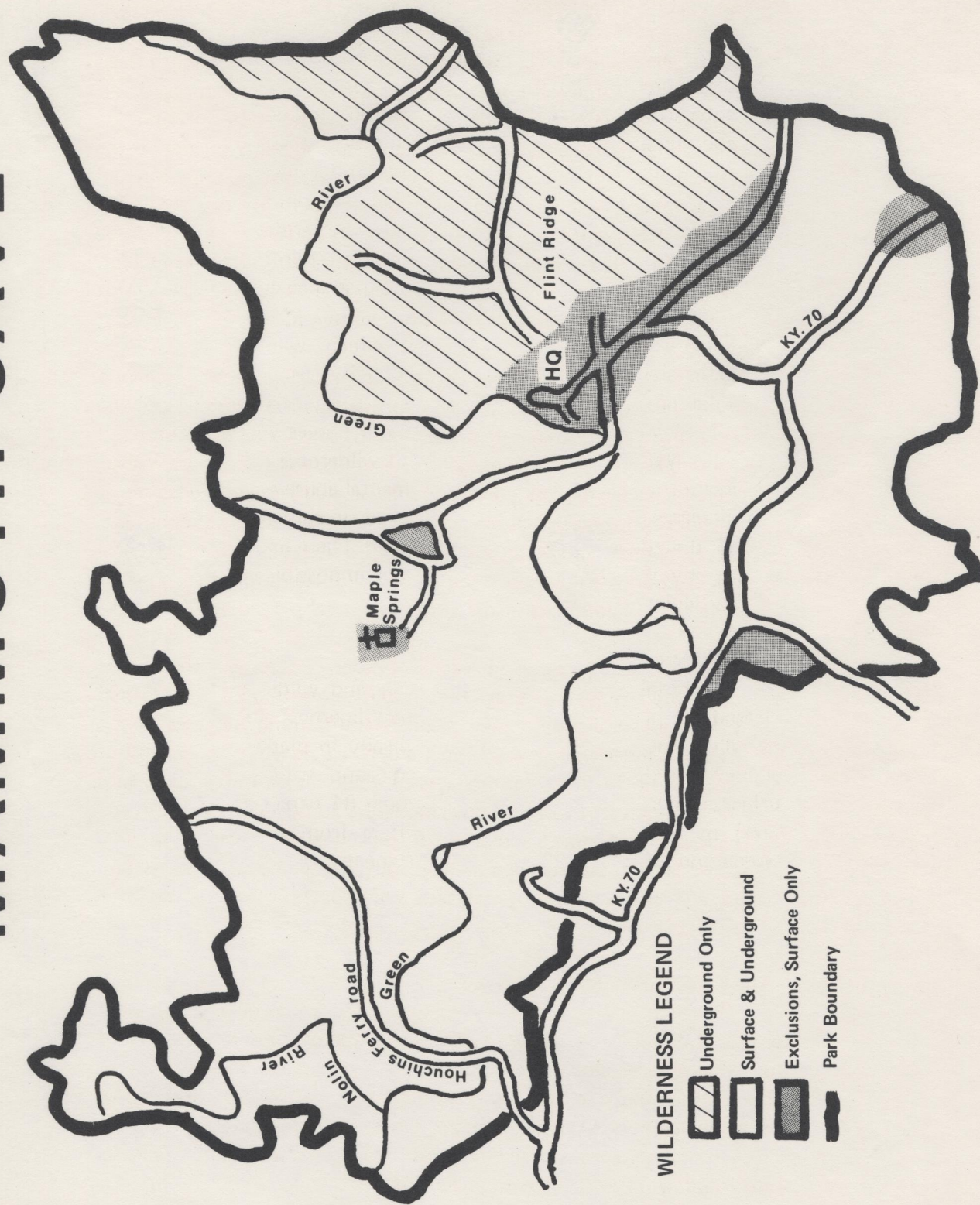
The underground wilderness proposal would preclude development of additional caves for interpretive use, because the extensive environmental modification and use of motorized equipment to make the environment usable and safe for the visitor would not be possible. The underground wilderness would result in concentration of additional cave development at Mammoth Cave, where crowding is already a serious problem. The underground wilderness would tend to reinforce the possible long-term impairment of the visitor experience cited above.

Evidence from other parks in which wilderness has been designated suggests that the publicity generated by formal wilderness designation may result in substantial increases in the use of wilderness areas. If this trend proves valid at Mammoth Cave National Park, the impacts of wilderness designation would include increased levels of environmental abuse associated with the increases in visitation that would occur earlier than if the area continued to be managed as wild land. These impacts may pertain to any wilderness proposal but are impossible to predict for a particular area.

2. The Wilderness Society Proposal

a. **Proposal** — After the master plan and wilderness study were released for public review in 1972, The Wilderness Society developed the wilderness proposal depicted graphically in plate 3. The proposal recommends both surface and underground wilderness areas. The surface wilderness proposal, encompassing 84 percent (about 42,000 acres) of the park's surface area, differs from the National Parks Association proposal in five important respects.

MAMMOTH CAVE



(1). All lands between Mammoth Cave Ridge and the Green River are excluded from wilderness.

(2). All existing public roads and several management roads are excluded.

(3). The slackwater portion of the Green and Nolin Rivers are excluded.

(4). A 320-acre area in the extreme southeast corner of the park is excluded to permit development of a staging area, as recommended in the master plan.

(5). The Good Spring Church near the Maple Springs Ranger Station and adjacent land is excluded.

The underground wilderness proposal is substantially more inclusive than the National Parks Association proposal. All underground features in the park are included in wilderness, except for "approximately nine and one half miles of electrically lighted passages under Mammoth Cave Ridge." (Only 6 miles of electrically lighted passages are currently in use.)

b. Impacts

(1). **Impacts on vegetation and wildlife.** The impacts of the surface wilderness proposal on vegetation and wildlife are similar to those indicated for the National Parks Association proposal, except that the magnitude of impacts will be reduced, because the acreage affected is about 10 percent less.

The general impacts of the underground wilderness are the same as cited under the National Parks Association proposal.

However, unlike the more limited NPA proposal, the underground wilderness will provide the protection of wilderness status to all cave biota, except in the intensively used portion of Mammoth Cave itself. Declines in the populations of the cave fauna in the latter area will almost certainly occur as the pressures of increased visitation continue, particularly because the National Park Service will not be able to expand the existing cave system into adjoining wilderness areas or establish new use areas in other caves.

(2). **Impacts on cave features.** Impacts are essentially similar to the National Parks Association proposal except that (a) impacts associated with visitor use in Mammoth Cave, such as minor vandalism and littering, would be greater by an unknown amount, because the National Park Service would be unable to expand the existing use area and (b) the long-term impacts associated with precluding the development of cave features outside the Mammoth Cave use area for intensive visitation would be substantially greater.

(3). **Impacts on esthetics.** Same general impacts as described for National Parks Association proposal.

(4). **Impacts on access and circulation.** The immediate impacts of the surface wilderness proposal on access and circulation by visitors, area residents, commercial interests, or park personnel, would be negligible, because no public-use roads or essential management roads would be closed. However, the wilderness would prevent redesign of the road system to establish a single transpark road with a bridge crossing to replace the existing two roads with ferry crossings, as recommended in the master plan. The impacts of this action, as analyzed in section III.C.8., would not occur.

Even though the proposal recommends the exclusion of appropriate land for establishment of a mass transit staging area in the park's southeast corner, implementation of the mass transit system as recommended by the master plan would be impossible, because the necessary vehicle corridor between the staging area and Mammoth Cave Ridge could not be constructed through a wilderness area. The described impacts of this proposal (section III) would not be realized.

The wilderness proposal would have no impact on use of motorboats on slackwater portions of the Green River and Nolin River for internal park circulation, because such waters are excluded from wilderness. Free-flowing sections of these streams that are included in wilderness generally are not suitable for motorboat use. Inconvenience to visitors due to their inclusion in wilderness should be negligible.

The long-term impacts of the wilderness proposal on access and circulation will depend on the types and locations of future

development and land uses. These impacts are impossible to predict at this time.

(5). **Impacts on recreational use and development.** The surface wilderness proposal would have no immediate effects on development and recreational use. No recreational uses, other than primitive camping and hiking, have been proposed for the wilderness area, and the impact on use in the foreseeable future is likewise negligible.

The extensive underground wilderness will severely restrict future development of trails and interpretive facilities in both Mammoth Cave and other unused caves. Use of Mammoth Cave would probably have to be regulated by a permit system in the near future to preclude overcrowding by visitors. The proposal therefore will have no impact on the kinds of use presently occurring in the cave system, but will significantly limit the numbers of people who can be accommodated.

3. National Speleological Society Proposal

a. **Proposal** – Prior to completion of the master plan in 1967, the National Speleological Society conducted a study of the park's resources and prepared a proposal for designation of surface and underground wilderness areas (plate 4). The surface wilderness proposal, encompassing about 52 percent of the park's land acreage, excludes the following areas from wilderness.

(1). All lands south of the Green River and north of State 70, (except that the Flint Ridge lands between Mammoth Cave Ridge and the Green River are recommended for wilderness designation pending removal of development and a determination by the Secretary of the Interior that they qualify).

(2). Lands north of the Green River and west of the Nolin River near the western boundary of the park.

(3). Lands on the park's north boundary at Ollie that were recommended for a visitor contact station and campground.

(4). Lands adjacent to the ranger station at Maple Springs.

(5). A small tract south of State 70 and west of State 422 on the south central park boundary that was considered too small for wilderness designation.

- (6). All public-use roads and major management roads, except the Houchins Ferry Road at the western end of the park.

The proposed underground wilderness includes all cave features south and east of the Green River in the karst southeastern part of the park, except for the 50-mile-long network of cave passages under Mammoth Cave Ridge.

b. Impacts

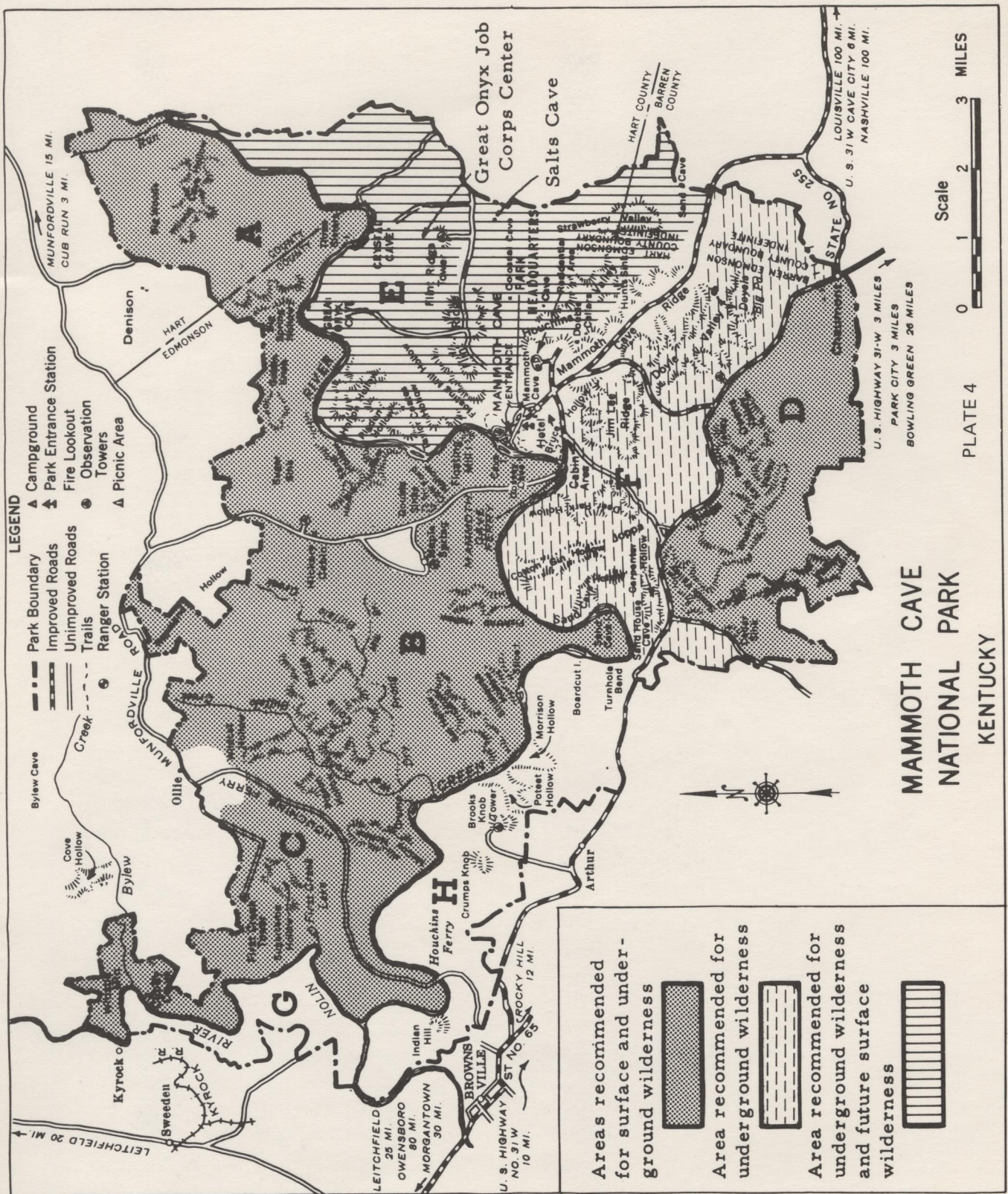
- (1). **Impacts on vegetation and wildlife.** The impacts of the surface wilderness proposal on vegetation and wildlife are similar to those indicated for the National Parks Association proposal, except that the magnitude of the impacts will be considerably less, because 44 percent less surface land area will be affected.

Impacts of the underground wilderness designation should be similar to those identified for the NPA proposal, because the same general areas are included in wilderness.

- (2). **Impacts on cave features.** Impacts are identical or nearly so to those described in the National Parks Association proposal.

- (3). **Impacts on esthetics.** Impacts are similar to those described in the National Parks Association proposal, except that the reduced surface wilderness acreage increases the flexibility of the National Park Service to manage the park in ways which create greater esthetic diversity (controlled burning of forests, clearing of vegetation, establishment of new developments, etc.). Establishment of an esthetically uniform environment as a result of natural plant succession will be somewhat less likely under this proposal than under the NPS alternative.

- (4). **Impacts on access and circulation.** Impacts are similar to The Wilderness Society's proposal, except that closure of the Houchins Ferry Road between the Green River and Wildcat Hollow will limit transpark vehicular travel at the western end of the park. Inconvenience to visitors will be minor, as most transpark travel occurs on the Mammoth Cave Ferry Road through the center of the park. The impairment of travel along the transpark shortcut between Brownsville and Ollie will be considered a significant impact by a few local residents (numbers undetermined). The actual time delays should be minor. The



low-standard road to be closed requires a 5 to 10 minute delay at the ferry crossing of the Green River; the higher-standard roads skirting the park on the west would require traveling about 8 miles farther between Brownsville and Ollie, but increased speed and absence of the ferry crossing should make the duration of the longer trip about the same.

(5). **Impacts on recreational use and development.** The proposal differs from the National Parks Association and The Wilderness Society proposals in that large areas in the western and southwestern parts of the park are excluded from wilderness and are therefore available for development and non-primitive recreational uses. The immediate impacts of the proposal on recreational use and development should be minimal, as there are no plans to develop these excluded lands. All three alternative proposals preclude development of a single transpark road, the impacts of which would not be realized (see section III.C.8.).

Impacts of the proposed underground wilderness designation are the same as for the National Parks Association proposal.

4. National Park Service Proposal

a. **Proposal** — The land classification plan, prepared as part of the master plan and described on pages 31-36, includes recognition of natural areas and outstanding natural areas that might someday be designated wilderness pending removal of development and a determination by the Secretary of the Interior that they meet the criteria for wilderness designation (see map, page 33). These lands, which comprise 21,460 acres or 41 percent of the park's acreage, include the following areas.

- (1). The Woolsey Valley in the southern part of the park.
- (2). The northern part of Flint Ridge west and north of the powerline and south of the Green River.
- (3). The free-flowing portion of the Green River in the northeastern part of the park.
- (4). Lands north of the Green River and east of the proposed transpark road which are not required for access, public use, management, or possible future development. These lands were considered for immediate wilderness designation. No underground wilderness was proposed.

b. Impacts

(1). **Impacts on vegetation and wildlife.** Impacts are similar to the National Parks Association proposal, except that the acreage affected would be about 55 percent less, thereby altering the magnitude of the impacts proportionately.

(2). **Impacts on cave features.** The surface wilderness proposal will have no significant impact on access to, use of, or development of Mammoth Cave or other caves known to be suitable sites for interpretation. The proposal will have no direct effect on the integrity of cave features.

(3). **Impacts on esthetics.** Impacts are similar to the National Parks Association proposal, except that the potential long-term reduction in the park's esthetic diversity will be less, because 55 percent less land would be designated wilderness.

(4). **Impacts on access and circulation.** The proposed surface wilderness would have no impacts in the foreseeable future on access to or circulation within the park. No existing or proposed public-use roads or major management roads would be closed as a result of designating these areas wilderness and no inconvenience to visitors, local residents, or commercial interests would result.

(5). **Impacts on recreational use and development.** The proposed surface wilderness would have no effect on existing or proposed recreational use and development. The areas are presently managed as wild lands, and there are no plans to change their status by implementing non-primitive development and recreational uses. Because nearly 60 percent of the park's acreage would still be available for expansion of recreational development and diversification of recreational uses, impacts on future planning options should be negligible.

IX. CONSULTATION AND COORDINATION WITH OTHERS

A. CONSULTATION AND COORDINATION IN THE DEVELOPMENT OF THE PROPOSAL AND IN THE PREPARATION OF THE DRAFT ENVIRONMENTAL STATEMENT

In the development of the proposals in the draft master plan, the National Park Service consulted closely with the following citizen members of the planning team:

Dr. Thomas C. Barr, Jr., Professor of Zoology
University of Kentucky, Lexington.

Dr. William B. Holton, Retired Scientist
Chevy Chase, Maryland.

Don Lockwood, Park Planner, National and Historic Parks Branch,
Ottawa, Canada.

Dr. Bassett Maguire, Jr., Associate Professor of Zoology,
University of Texas at Austin.

Consultations were held with representatives of the park's concessioners:

National Park Concessions, Inc.

"Miss Green River" Boat Concession.

with representatives of the following agencies of the Federal Government:

Geological Survey

Corps of Engineers

Bureau of Outdoor Recreation

Bureau of Public Roads (Federal Highway Administration)

with representatives of the following offices in the Commonwealth of Kentucky (July, 1968):

Office of the Governor

Department of Highways

Department of Parks

Department of Natural Resources

Department of Public Information

Department of Fish and Wildlife Resources

Fiscal Court Judges of Edmonson and Barren Counties

with representatives of the following conservation organizations:

The Wilderness Society

Cave Research Foundation

National Speleological Society

National Parks and Conservation Association

and with National Park Service specialists in geology, landscape architecture, architecture, engineering, transportation, history, park maintenance, interpretation, biology, visitor and resource protection, concessions management, park management, and park planning.

The master plan team also had the benefit of the papers presented at and resulting from a "Symposium on the Application of the Wilderness Act as the means for preserving the surface and the underground features of Mammoth Cave National Park" which was held at the park May 22-26, 1967. Attending were representatives of the concessioners, members of the park staff, representatives of the Geological Survey, National Speleological Society, Cave Research Foundation, a Regional Coordinator of the office of the Secretary of the Interior, and Dr. Bassett Maguire, Jr. of the University of Texas.

A public meeting was held at the park on May 25, 1968 by the master plan team to listen to comments by public officials, organized groups, and citizens about the future use and development of the park. A statement was made in behalf of Congressman William H. Natcher (Ky.). Then there were seven county and city officials, 16 representatives of various state agencies and public bodies, 18 representatives of organized groups, and 13 individuals who spoke and expressed their views. In addition, a few statements were sent by mail.

Subsequently, many newspaper articles and editorials have appeared, a host of resolutions have been passed by civic bodies, several articles have been printed in periodicals, and conservation organizations have refined and published their comments upon the proposals in the master plan.

While much of the same background material was used for evolving the proposals in the draft master plan and for preparing this draft environmental impact statement, more specific data for the latter was obtained when necessary by further consultation with specialists.

B. COORDINATION IN THE REVIEW OF THE DRAFT ENVIRONMENTAL STATEMENT

The following agencies and organizations have been asked to comment upon this environmental statement:

Department of the Interior

- Bureau of Outdoor Recreation
- Bureau of Sport Fisheries and Wildlife
- Bureau of Mines
- Bureau of Land Management
- Geological Survey

Department of Agriculture

- Forest Service
- Soil Conservation Service

Department of Defense

- Corps of Engineers

Department of Transportation

- Federal Highway Administration

Department of Commerce

- Economic Development Administration

Environmental Protection Agency

Advisory Council on Historic Preservation

Commonwealth of Kentucky

- State Clearinghouse
- State Historic Preservation Officer
- Barren River Area Development District
- County Judge of
 - Barren County
 - Edmonson County
 - Hart County
- City Council of
 - Brownsville
 - Cave City
 - Horse Cave
 - Park City

Wilderness Society

National Parks and Conservation Association

Sierra Club

National Audubon Society

Cave Research Foundation

National Speleological Society

National Park Concessions, Inc.

"Miss Green River" Boat Concession

Mammoth Cave National Park Association

B. COORDINATING ATTACHMENTS
 ENVIRONMENTAL STATEMENT
 The following agencies and organizations have been asked to comment upon this
 environmental statement:

Department of the Interior
 Bureau of Outdoor Recreation
 Bureau of Sport Fisheries and Wildlife
 Bureau of Mines
 Bureau of Land Management
 Geological Survey
 Department of Agriculture
 Forest Service
 Soil Conservation Service
 Department of Defense
 Corps of Engineers
 Department of Transportation
 Federal Highway Administration
 Department of Commerce
 Economic Development Administration
 Environmental Protection Agency
 Advisory Council on Historic Preservation
 Commonwealth of Kentucky
 State Clearinghouse
 State Historic Preservation Officer
 Barren River Area Development District
 County Judge of
 Barren County
 Edmonson County
 Hart County
 City Council of
 Brownsville
 Cave City
 Horse Cave
 Park City
 Wilderness Society
 National Parks and Conservation Association
 Sierra Club
 National Audubon Society
 Cave Research Foundation
 National Speleological Society
 National Park Concessions, Inc.
 "Miss Green River" Boat Concession
 Mammoth Cave National Park Association



COMMONWEALTH OF KENTUCKY
Kentucky Heritage Commission
CORNER IN CELEBRITIES
FRANKFORT, KENTUCKY 40601
MRS. SIMEON WILLIS
STATE LIAISON OFFICER

Mr. David D. Thompson, Jr., Regional Director
Southeast Regional Office - National Park Service
3401 Whipple Avenue
Atlanta, Georgia 30344

Dear Mr. Thompson:

Thank you for sending copies of the preliminary Draft Master Plan and preliminary Draft Environmental Impact Statement for Mammoth Cave National Park, Kentucky. We have reviewed both documents and we are glad to see that consideration has been given to historic sites located within the boundaries of the Park, which might qualify for nomination to the National Register of Historic Places. We trust that the Park Service will proceed to nominate those sites determined to be eligible.

With regard to your statement about the joint Memorandum of Agreement, it is our understanding based on information directly from the Advisory Council, that the Advisory Council itself is responsible for initiating the joint Memorandum. With this in mind, we would not want to take action in contradiction to the procedures of the Advisory Council. However, should we receive copy of a joint Memorandum of Agreement initiated by the Advisory Council, we will be glad to review it.

With kind regards, I remain

Sincerely,

Mrs. Simeon Willis
State Historic Preservation Officer

December 18, 1973

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